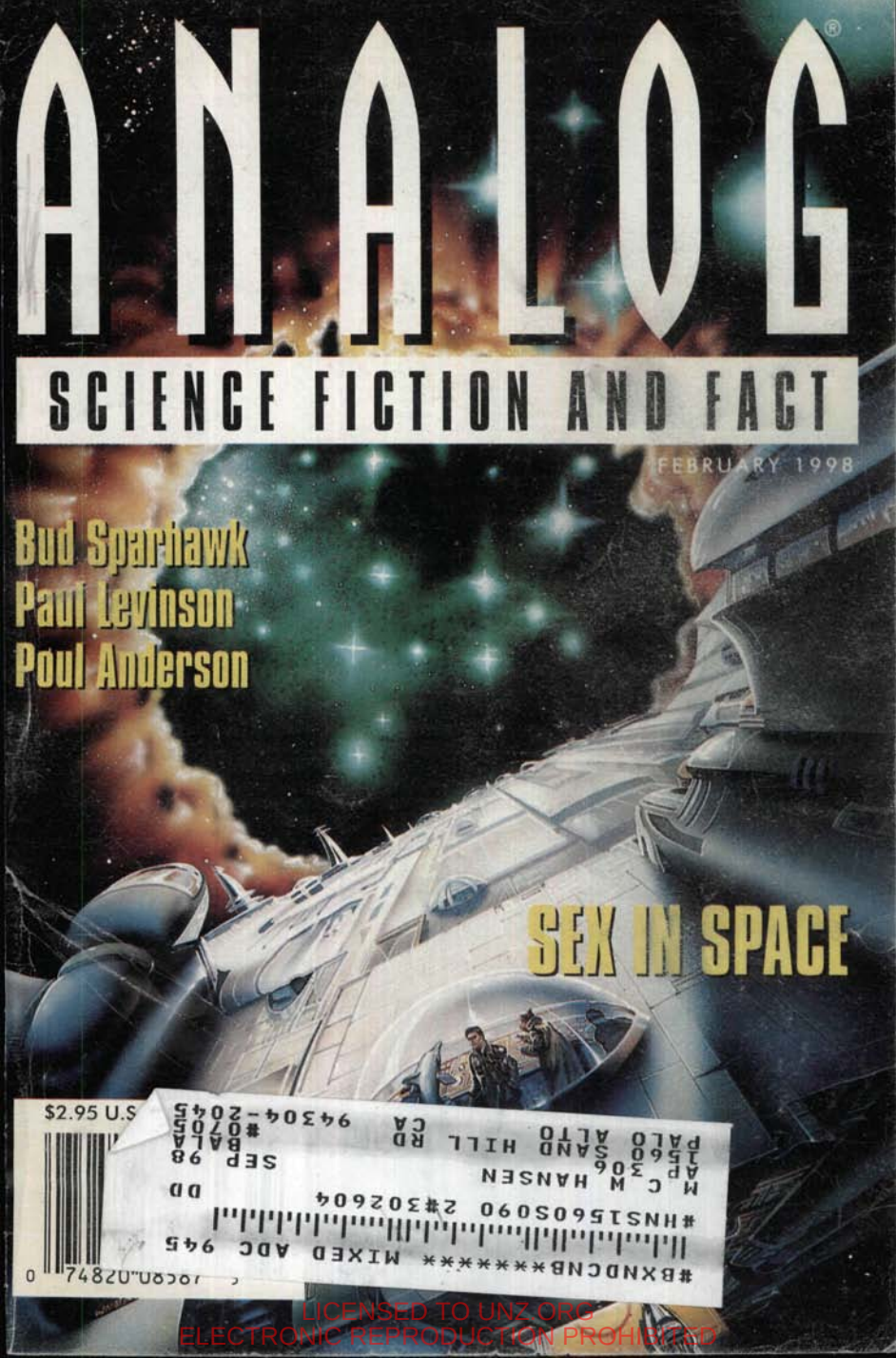

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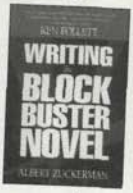

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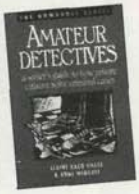

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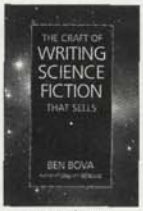

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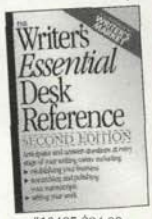

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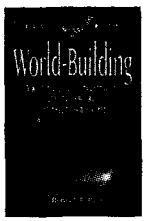

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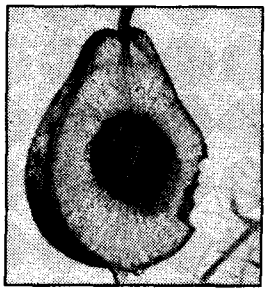

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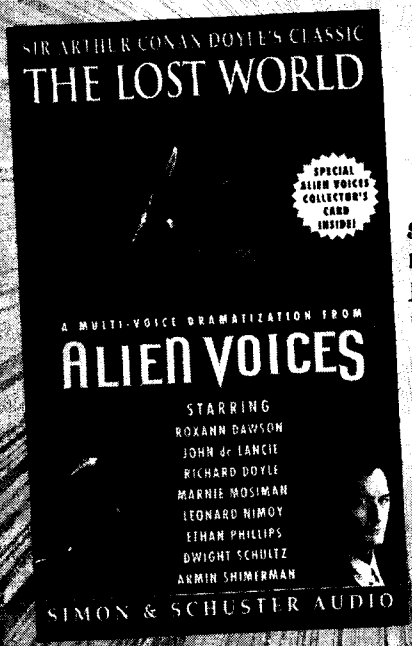

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EDITORIAL Stanley Schmidt

THE RETURN OF MR. ROBOT

For many of us, a major highlight of the summer of 1997 was the July 4 landing of Pathfinder on Mars. The first human-built craft to land there in 21 years, it brought something new and special with it: a small "rover" named Sojourner which could roll around taking close looks at things some distance from the lander itself. Not *large* distances, of course; since it would be largely on its own—the many minutes required for a radio signal to pass between Earth and Mars ruled out real-time remote control—Sojourner necessarily moved in a very deliberate manner. Nevertheless, it managed to sample the composition of several neighboring rocks (promptly given nicknames like "Barnacle Bill" and "Yogi") and find plenty of surprises to keep Earth's planetologists busy for quite a while.

For me, Sojourner had an extra, personal significance. My first published story ("A Flash of Darkness," *Analog*, September 1968) was about a Mars Rover robot (nicknamed MR. Robot), so I got a special kick out of seeing a real one take its first steps. The real one was not, of course, exactly like my fictional one; but then, science fiction writers have never been in the business of predicting what the future will *really* be. One detail, interestingly, I did get almost exactly right: I thought of my story as taking place right about now. But I also thought of my rover as the fourth of its kind, and I gave it a considerably more sophisticated "brain," a lot more mobility (it walked on three legs instead of rolling on wheels, and roamed much farther from the ship that brought it), and a holographic vision system.

I didn't actually expect the first real rovers to have holographic vision systems, but, like many stories, mine had a convoluted history. The idea of a holographic vision system, and how differently the owner of one might see the world, was what came first—at least in part, no doubt, because I'd been doing some research in holography myself. I originally used the idea in a completely different story which John Campbell, then *Analog*'s editor, found unconvincing. "But," he said, "it's a lovely idea." He went on to tell me about some research that was being done at MIT, with the express goal of developing a Mars Rover robot. (A couple of years later, in May 1970, he published a very long fact article, under the title "MR. Robot," by Louis L. Sutro and William L. Kilmer, describing that research in considerable detail.)

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Why not, he suggested, give *that* your holographic vision system?

So I did. It would be a neat thing for such a robot to have, but it would also be expensive and difficult to build—though not, apparently, impossible. When I wrote the story and had been working in the field, researchers asked about the feasibility of real-time holographic television transmission gave answers ranging from "Never" to "Maybe in a couple of centuries, but surely not sooner." Knowing that science fiction writers tend to be only slightly less hyperconservative in their predictions than scientists, I deliberately set my story a mere thirty years in the future. Five years later, a research journal article remarked casually that the equipment for real-time holographic television transmission currently cost about $30,000, but that would come down if enough people were interested enough.

I haven't heard much about it since, so I suspect they weren't. In any case, applying the method to a real Mars Rover would pose big extra problems, including supplying the power to illuminate a real landscape with coherent light and the bandwidth to collect, store, and transmit an awful lot of information. So it's not surprising that that aspect of my fictional robot was not used on the first real one. The other respects in which my vision seems too optimistic stem from one big factor that I did not foresee: the loss of momentum and budget in the space program brought on by political factors. Sojourner, the real "MR. Robot I," was the product of a space program redesigned to be "faster, cheaper, and better." "Better" is the subject of a debate I won't get into today, but it's certainly faster and cheaper and there are at least some advantages to that. I haven't had a chance to make a detailed comparison of Sojourner and the MR. Robot described by Sutro and Kilmer in 1970, but from what I've read, I suspect Sojourner is a good deal simpler.

But still sophisticated enough to do useful and intriguing things that have never been done before—and it is, after all, the first real device of its type. If what it does is judged valuable enough, we might reasonably hope to see more highly evolved descendants doing still more a few years hence.

But the extent to which that happens will depend on human reactions to Sojourner and its findings—so it behooves anyone interested in the future of space exploration to keep an

Analog Science Fiction and Fact (Astounding) is published monthly except for a combined July/August double issue by Dell Magazines, a division of Crosstown Publications. One-year subscription for $33.97 in the U.S.A. and possessions, in all other countries, $41.97 (GST included in Canada, GST # 123054108) payable in advance in U.S. funds. First copy of new subscription will be mailed within eight weeks of receipt of order. When reporting change of address allow 6 to 8 weeks and give new address as well as the old address as it appears on the last label. Periodical postage paid at New York, NY, and at additional mailing offices. Canadian postage paid at Windsor, Ontario. Canada Post International Publications Mail, Product Sales Agreement No. 280622. © 1998 by Dell Magazines, a division of Crosstown Publications, all rights reserved. Protection secured under the Universal Copyright Convention. Reproduction or use of editorial or pictorial content in any manner without express permission is prohibited. All stories in this magazine are fiction. No actual persons are designated by name or character. Any similarity is coincidental. All submissions must be accompanied by stamped self-addressed envelope, the publisher assumes no responsibility for unsolicited manuscripts or artwork. USPS 488-910, ISSN 1059-2113

POSTMASTER: Send change of address to: ANALOG SCIENCE FICTION AND FACT
P.O. Box 54625, Boulder, CO 80328-4625.
IN CANADA RETURN TO: 3255 WYANDOTTE STREET EAST, WINDSOR, ONT. CANADA N8Y 1E9
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eye on what people are saying and doing in response. And, just as in the case of Dolly the sheep clone, those human reactions have been one of the most interesting parts of the show.

Some of them are just . . . puzzling. One major news magazine devoted a whole page to an essay musing on the "fact" that the pictures sent back from Mars "tell us that we are alone in the universe." Very poetic, but logically about as valid as taking a quick peek into the vegetable drawer of my refrigerator, seeing no telephones there, and concluding that there are no telephones on Earth. Sojourner's pictures, unless they happen to show some clear evidence of other life, tell us *nothing* about whether we are alone in the universe. I can think of no useful purpose served by promulgating the idea that they do.

A similarly fuzzy, if all too predictable, reaction was found in a Gannett feature article headlined, "Getting Beyond the Mars Hype," with the subhead, "Mission may be a great show, but some question real payoff." Well, of course, they do. They *always* do—and far be it from me to suggest that they shouldn't. Most *Analog* writers and readers agree that *everything* is subject to question—but with the corollary that the questions should be answered with due consideration of all relevant facts, not just feelings or prejudices.

"What interests me," says one interviewee quoted in that article, "is how much it costs. What do we get from it besides 'Wow, this is neat'?" And the article itself later says, "The mission's scientific significance is much less exciting. The great variety of rocks that has geologists agog looks pretty uniform to the average person."

The cost, as it happens, is about a

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First issue of Astounding January 1930 ©

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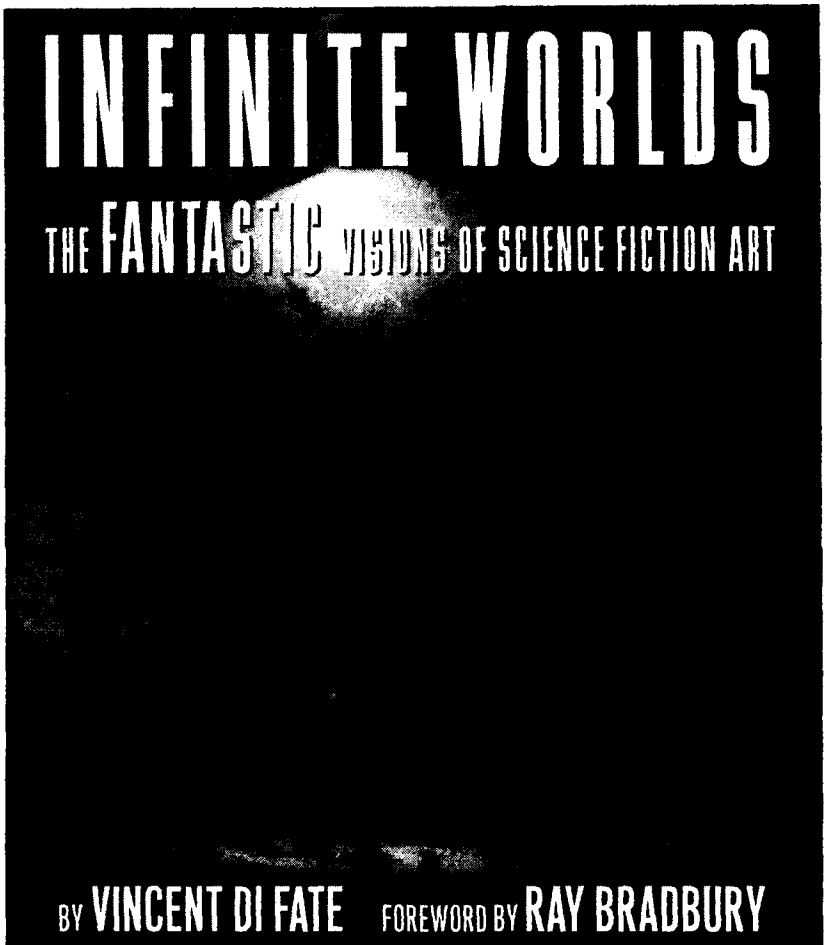

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dollar per American—about the same as a small order of fries or a minute of cell phone airtime, and trivial compared to the cost of most other government programs that we are all compelled to pay for. Nevertheless, it's a fair question, and since space exploration is not, to most people, a clear *necessity*, it's to NASA's benefit (and ultimately everybody's) to try to make them understand the value of such work. "Exciting" is in the eye of the beholder, and discoveries like those made by Pathfinder and Sojourner tend to excite those who understand them and bore (after the initial rush of TV coverage) those who don't. Those things *aren't* "just rocks," of course, and it's cute but hardly very bright to dismiss the whole thing by saying it looks just like Tucson and Tucson is cheaper to get to. Nevertheless, it's not realistic to expect the general public to motivate itself to learn why Mars is different and worth the expense. Those who know, if they want to keep getting funded, will have to tell them—and tell them in a way that grabs and holds their attention long enough to get the point.

Which leads me to two final reactions I've heard, which may seem unrelated to each other and to the foregoing, but aren't. The first is from a syndicated columnist who enjoyed the show but was fascinated, and apparently a little disturbed, by the tendency of scientists, press, and public to anthropomorphize the rover and the rocks, giving them nicknames and talking about the rover, if only jokingly, almost as a human colleague. She found it ironic that people were "humanizing" technology while "technology has been dehumanizing everyday life." That last is a complaint we've all heard often, but is often exaggerated and has probably been heard as long as there has *been* technology (which is a *long* time).

We've all heard people grumble about e-mail and on-line chat rooms, for instance, describing them in such terms as "interacting with a keyboard rather than with another human being." But how many of these same people shun all contact with a telephone or view it as "interacting with a handset rather than with another human being"? On-line conversation is *not* "interaction with a keyboard"; it's simply a new way of interacting with another human being. Just like the telephone; the main difference is that the telephone has been around long enough for most people to recognize that, while e-mail is still new enough to bother those who instinctively squirm at the touch of the unfamiliar.

The "humanizing of technology" may actually be a healthy sign, a sign that some people are becoming more comfortable with new elements in their lives. Which leads me to the other reaction I mentioned. An *Analog* reader expressed concern that NASA and JPL scientists associated with Pathfinder were using those nicknames (like "Barnacle Bill") in public reference to rocks and formations on Mars. He was concerned that such informality might further blur the boundaries, already fuzzy in much of the public mentality, between astrology and astronomy, UFOlogy and SETI. "I believe in generous tax funding for

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projects of pure science," he wrote, "but I also believe that this funding has a price: The scientist must share his or her findings with the public in a manner that is easily understood and readily digested. This obligates the scientist to act as a public educator, and the use of cute nicknames is inconsistent with this goal."

I agree wholeheartedly with his concern for sharing scientific findings with the public in a manner that is easily understood and readily digested, but I don't agree at all that the use of cute nicknames is inconsistent with this goal. In fact, done with care and skill, I think—as one with a good many years of experience as a professional science educator—that it can make an important contribution to the effort. When I was teaching physics and astronomy, I often and deliberately used humor and whimsy in my lectures and even test problems. Over and over I found that the same students who would freeze up in terror at a twin paradox problem about "Two twins named A and B" would chuckle and relax just enough to get interested, dig in, and *think* about the same problem if it was couched in terms of "Twin aardvarks named Arnold and Jerome."

I was not a maverick or even particularly original in this. I was consciously emulating the best elements of the best teaching I ever received myself. One of the best models of good teaching I ever saw (not in person, unfortunately, but on film) was Nobel-winning physicist Richard P. Feynman, who used humor freely and skillfully to convey quite esoteric insights to audiences at all levels of sophistication.

Science is, among other things, *fun*; and that's one of the important things about it that the general public finds hardest to grasp. The conscientious avoidance of cute nicknames and jokes may be well-intentioned, but tends to produce precisely that sense of dryness that turns so many people off of science. It's high time that we had more scientists who can share not only the understanding, but the fun and excitement that drew them into this work. Only through them, I think, can we create and maintain the popular support that will let the new era of space exploration launched by Pathfinder and Sojourner flower. ■

Analog Science Fiction and Fact is published monthly (eleven issues, one being a double) by Dell Magazines, a division of Crosstown Publications, 1270 Avenue of the Americas, New York, NY 10020; shareholders owning 1 percent or more are Penny Press Inc., Selma, William, Andrew, John, James, and Peter Kanter, 6 Prowitt St., Norwalk, CT 06855-1220. There are no mortgages or other security holders. Total average copies printed: 71,905; 53,372 total paid circulation.

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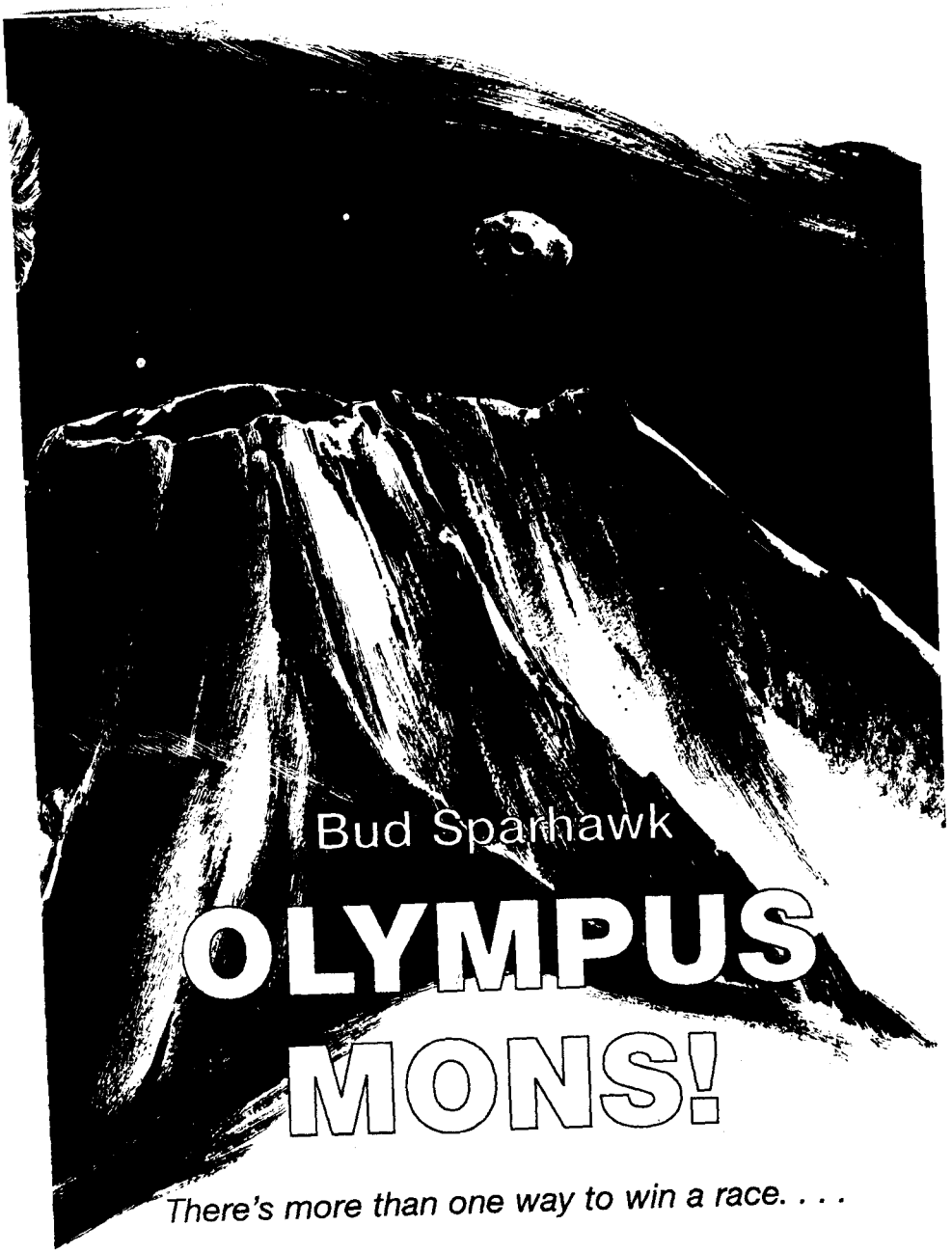

Bud Sparhawk

OLYMPUS MONS!

There's more than one way to win a race. . . .

Illustration by Vincent Di Fate

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Haley Surra watched Taylor walking toward her across the Marsport concourse. "Cocky kid," she muttered to herself as he came nearer. Why couldn't he leave her alone with her misery? He knew that she was a freaking jinx, a lousy albatross, just like everyone said. Hadn't she already done enough to screw him up? Hadn't the jinx made him lose the race? Hadn't her lousy bad luck nearly ***killed*** them?

What the hell did he want *now?*

The first time Taylor saw Surra was in a cheap bar frequented by Mars grubbies and indentured workers; people who could only afford the cheap spiced liquor they served there. He'd taken a cup of the clear, searing, pepper-infused whiskey and nearly choked on his first sip.

"Grew the peppers in the old lady's dirt," the barkeeper had boasted proudly as she topped off his cup. "Gives it that added zip, y'know. What brings you to Jovus bubble?"

"The Chu San race," Taylor'd replied. "I thought that was obvious." With his expensive clothes and pale skin he knew that he stood out among these hard scrabble types like a beacon on an orbiter. "But right now, I'm looking for a grubbie who knows Mons," he added.

The barkeeper flopped into the chair opposite him. "Wouldn't call prospectors that to their faces, were I you. Besides, you're probably too late." She looked around the room. "All the 'spectors willing to run the mountain have been hired."

"Heard there was a woman—Haley Surra—who hasn't teamed. Said I could probably find her here."

The barkeeper stood up abruptly. "Don't know that she'd want to help, though. Got a bunch of family problems that's taking most of her time, I hear. But I'll keep an eye out."

Taylor looked around at the crowd as the woman returned to the bar. Most were paying close attention to the news scrolling across the wall screen but a few were conversing intently in the Martian native's low growls. A thin woman sat alone and stared at the ruddy desert outside through the observation window behind the bar. There was a half-empty cup in front of her. She turned and glanced his way after the barkeeper whispered something to her.

Taylor smiled at her and returned to his newly refreshed drink, sipping another minute quantity to see if limiting the volume would reduce the sting.

It didn't.

"Sheila says you've been looking for me," the sharp-featured woman who'd been at the bar said as she sat down. When he didn't immediately respond she added; "I'm Surra—Haley Surra. What's on your mind?"

Taylor Blacker looked at her and wondered if he had been led astray. His potential navigator turned out to be a slight woman with sharp cheekbones and a characteristic Mars tan. She was so thin that he wondered why even the weak breezes of Mars hadn't whisked her away. She was not an imposing sight, not by half. She was hardly what he'd expected.

"Seen enough," she said gruffly.

"I've been told that you know the

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mountain pretty well," he started. "Fellow down in Marsport told me that you probably were the best grubbie I could find."

Surra stared at him for such a long time that he wondered if his inspection of her had given affront. Finally, she responded. "You are so full of crap; the only reason you are talking to me is that you haven't been able to find anyone else—right?"

Blacker shrugged. "Well—" he began.

"Let's get something straight right off," Surra interrupted. "I don't like people who lie to me. I don't like people who call us 'grubbies' and," she added angrily, "I don't particularly like fresh-faced kids who have so much money that they can afford to waste it on a stupid race down the old lady's skirts. Stuff your bullshit, pack your bags, and go back to daddy, kid. You ain't got a chance!"

Taylor grabbed her by the arm when she started to get up. "Listen lady, don't tell me I haven't a chance! I've been getting ready for this race for two years, ever since they announced it. I didn't drop down here from Jupe Station for nothing."

"Jovian, eh?" Surra said sharply, her eyes widening in surprise. "Well, that explains the accent and lack of manners."

"Sorry, I didn't mean to offend. Name's Taylor—best damn engineer in JBI. Specialty's systems and I think my bike's design has the best chance for winning the Chu San. I've got some specialized gear that will give us an edge. Even had the rig modified to provide the extra stability for the steeper slopes."

Surra slowly sat back with a grin on her face. "Shows how much you know, kid. The old lady doesn't have much of a slope," she laughed. "Hell, I doubt that she's got more than a thirty degree hill anywhere on her. It's speed you'll need in this race, and those idiots willing to ignore the risk of cracking up will probably win. You ready to do that, kid? Willing to put your young life on the line for something as stupid as fame and glory?"

Blacker ignored her barbs. "What you know about the mountain might give us an edge. I'm told that you know every square meter."

Surra nodded. "Worked it for years, me and my partners. Didn't get anything out of it but lots of debt, busted gear, and a rotten reputation."

"Is that why they call you Jinx?" he asked quietly.

Surra stood up. "You've got a nasty mouth to go along with your wealth, kid. Why don't you go home to daddy and find some other way to waste his money?"

Family! If she only knew. He'd kept his entry into this race a secret from his precious family. Hell, if gramps or pop knew about this they'd probably have a fit. Gramps would probably send a troop of his security people to kidnap him until the race was over. His father had protested him risking his life working the Jovian moons as an engineer, but his family finally accepted that — lots of training and the best equipment JBI could provide eliminated most of the risk. Doing something that, from their perspective, was as pointless as the Olympus Mons downhill race was another matter entirely.

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"Listen, lady, I've dumped every centime I earned from working the Jovian moons into passage here, the entry fees, and the modifications I needed on the bike. The money's my own, not my family's," he responded angrily, "and why the hell that's any business of yours I don't know. Listen, I might not be able to win this race without you, but I *am* going to race down that mountain. And I'll do it alone if I have to!"

Surra looked hard at him. "You've got balls, I'll say that, kid. But what's in it for me?"

"There's three thousand when we cross the finish line," he said quickly. "Win, lose, or draw." She started to turn away.

"All right, five thousand," he offered. "That's all I have left."

"Not enough to make me risk my neck, kid. What else you got?"

"Share the purse if we win," he said. Surra sneered. "And you can keep the bike after we're finished," he added in desperation and sat back, hoping that was enough. The bike was his last counter. He had nothing else to offer.

"Really?" she said, returning to her seat. "Bike's a pricey item." She seemed to consider the offer for a few minutes. "All right," she said at last. "I'll do it. You have all the permits?"

"Yes, but I have to admit that I was a little overwhelmed by the bureaucrats at Marsport. Took me four days to fill out all the waivers and get them processed. And the fees!"

"Government's a mite touchy over this race," Surra said quietly. "They want to make sure that anyone insane enough to enter won't hold them accountable for anything that happens. Lots of people been killed running the Chu San, trying to beat the record." The last was said with a note of sad regret in her voice, as if it was personal.

"Listen," she said, obviously collecting herself. "Have you given any thought to the route?"

Taylor smiled. He wasn't sure that he'd enjoy working with this pitifully thin, washed-out, abrasive woman, but what choice had he? "I figured on following Chu San's route."

Surra sneered. "That's what most of them will do. But there's a shorter way—riskier—but faster by an hour or so, providing your bike can handle it."

"With the modifications I've made she should be able to do fifty on the flat, and corner at thirty. That good enough for you?"

"Yeah, but you're pushing it with that kind of speed, maybe too much. Especially on the old lady's broken terrain. Lucky if you can get up to thirty, until you get to the plains, that is. Oh well, finish your drink and let's go somewhere where we can work on some ideas."

"So you're with me?" he stuck out his hand.

Surra hesitated, sighed, and then grasped his hand. "It's a deal. But it's just for the money. And the bike, of course," she added. "Now, finish your drink."

"We're going to win this race!" Taylor exclaimed and lifted his cup in salute.

"Yeah, to winning the freaking, idiotic race," she said with a note of resignation in her voice. She tossed the

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contents of her cup back with a quick twist of her wrist.

Taylor did likewise. The peppery whiskey burned even worse than before.

After their meeting in the bar Surra had shown him the tricky course she'd wanted to take. He wasn't sure that the risk of traversing the rimae, as the Martians called the long fissures that ran across Mons's skirts, was worth the savings in time and distance. He asked why they couldn't just follow the rimae-avoiding course that Chu San had followed twenty years before when she made her desperate run across the mountain to rescue the downed shuttle.

Back in '34 Chu had covered the distance in fifty-four hours and thirty minutes in her rover, a cobbled-up affair that she'd thrown together when it was clear that she was the only one close enough to get to the crash site before the crew's life support died.

Years later they'd whittled the time down to forty-eight and a fraction hours. Ten people had been killed trying to beat that record, the last just four years ago.

The attraction of breaking the record for a downhill race on the largest mountain in the Solar System was too much. Finally, responding to an onslaught of financial, political, and commercial pressures, the rump Mars government had decided to sponsor a formal race, one that would bring in much-needed revenue and attention.

"The tricky part of the race will be at the top, above Mars's atmosphere," Surra explained as she spread her photographic survey maps out on the table top. That fact alone still struck wonder in him. "We won't have the thicker air around us until we're nearly three hundred klicks down the old lady's skirts. But Mars's air is so thin we don't have to worry about it."

"Yeah, I know; it's so thin that it hardly comes up to your knees," he said, repeating the well-worn joke.

Surra didn't even smile. "When we're above the atmosphere it'll be tough going; bright highlights and stark shadow in the day and dim starlight at night. Have to use the headlights most of the time. Down below, the heavier air'll diffuse the light some, so we'll have decent vision during the day. Most of the racers should hit the finish line in late afternoon with the Sun behind them."

"We'll finish at noon—forty-six hours," Taylor replied quickly. "I want to cut at least two hours off the record!"

"You can't shave it by that much," Surra protested.

"Sure we can. You said you could save us an hour, didn't you? If I can cut off another hour with my bike's speed and stability, we can do it easily."

"Crazy kid," she muttered, but not so softly that he didn't hear. "What the hell do I know?"

They leaned over the maps and began to calculate the odds; balancing risk against time. Their final route was a compromise.

They'd arrived at Bottomos, the humorously named research station at the edge of Olympus's caldera, a few days before the start of the race. Surra

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swore with a straight face that the station was the lowest synchronous space station above the Martian atmosphere, lower than both Deimos and Phobos by several orders of magnitude.

The flat, cratered caldera around Bottomos was the lip of the Olympus volcano that spewed out the millions upon millions of tons of lava and formed the thousand-kilometer-wide mountain millennia before. The caldera was ten kilometers across and dotted with the relics of previous research projects. The radio tower sported antennae for various purposes and had a half-dozen microwave dishes that pointed to the widely scattered habitats surrounding the base of Olympus, including Rescue Point station, the final destination of the racers. There were four large satellite dishes, two pointed up and the others at each horizon, where they could acquire the synchronous satellites one-third of the way around the planet.

Also scattered about were the brightly colored temporary plastic blisters that covered a few of the racing bikes. Taylor's was colored a pale rose—the true color of Jupiter's great spot. The pressurized structures were more for the comfort of those working in them. The racers who couldn't afford blisters had to work on their bikes out in the open, wearing their suits.

"Adjust that cable, would you?" Taylor asked Surra as they prepared the bike for the race. The rough transport up the mountain had shaken quite a few things loose and he wanted everything brought back to spec before they put it on the starting line.

Surra nodded and turned the tensioning spring's bolt until the mark on the steering cable came even with the indicator scratch he'd marked on the strut. "Done," she said and turned her attention to the cradle that would hold her at the bike's side.

The four-meter-long vehicle was Taylor's modification of an ordinary three-wheeled prospector's cart. He'd stripped the high saddles from its back and mounted cradles—open stretchers is what they resembled—on either side. They'd be riding in a prone position instead of sitting up.

"Putting our weight as low as possible on the sides brings the center of gravity down," he explained to Surra. "That gives us greater stability and allows the bike to handle turns better. That's why I put those skids underneath, to stop the cradle from dragging if the bike does bank too far."

The huge front wheel was a fat metal mesh that acted as the shock absorber and driving wheel combined, thus saving weight and simplifying construction. Taylor'd replaced the wheel's standard drive motors with a pair of high torque induction units that would deliver higher rpm's on a lower electrical load. He'd also installed a capacitive discharge system that would provide a better acceleration. "They're the same motors we use for the hoists on JBI's sailing ships," he explained.

Taylor had the rear metal mesh wheels splayed wider—nearly twenty degrees—than usual, again for stability. The top edges of the wheels just barely cleared the fairing of the bike's main body.

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Aside from the lack of saddles, the body of the bike was fairly standard. A set of extension hoses ran from the life support connections to each of the outboard cradles. There was the standard radio dish at the back of the bike, and inside were the usual batteries, air and water tanks, and storage space. For this race that space contained spare gear instead of the usual prospector's collection of equipment, tools, and supplies.

Steering and other control cables had been run out of the side of the fairing to yokes at the head of each cradle. "Duplicate controls so one of us can rest while the other drives," Taylor explained when she asked.

"You really think you'll get any rest during this race?" she asked.

"Have to. No way we can both stay awake and alert for two whole days," he replied.

As far as she could see he'd made only minor modifications to the frame and running gear of the bike and thereby stayed within the design parameters that had been set for the racers.

Taylor'd also "borrowed" a precise inertial navigation instrument from JBI. It would provide them with a detailed picture of their precise location on the mountain. The inertial was accurate to within a half-meter and designed to withstand the intense beatings as the ships were tossed about by Jupiter's fierce storms. He doubted that a little vibration from the Mars bike would affect it at all.

Using the photo-maps, Surra and he had programmed the unit for every centimeter of the route they intended to follow. They would know exactly where they were even if they couldn't see where they were going. Of course, there was nothing that could obscure their vision, so they would never have to exercise that option.

Surra proved that she had the best route and had shown him the details on her map back in her room. She knew a few things about the old lady that wouldn't show up in the photos. He would never have thought about the small craters caused by millennia of meteor bombardments on Olympus's flanks, nor the hair-thin cracks that were still wide enough to catch a wheel were they to enter on a shallow angle. But she knew how to steer clear of these minor obstacles.

The path that she wanted to follow appeared foolish and frightening at first. She wanted them to leave Chu San's route and traverse a set of rimae to the southeast. The width and depth of those deep cracks would convince the others that they should swing to the north and west. *That* would take them on a long time-and distance-wasting switchback. If Taylor's bike could make it through the shallow fissure, as Surra swore they could, they would save considerable time.

"I'll trust your judgment," he'd agreed cautiously as he squinted at the map. "But if I die *you're* going to have to deal with grandpa!"

"Got the balls to drive like a bat out of hell down the biggest mountain in the Solar System but can't deal with your own grandfather!" she said incredulously. "You're a wonder, Taylor; a blooming wonder."

"You haven't met JB," Taylor

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warned. "He's a rough old coot who'd sooner die than admit he's wrong on anything. He's intimidated me ever since I can remember."

He hesitated, wondering just how much to let her know about his family. "Getting out from under gramps is why I'm doing this." he started to explain but, when he saw her raise an eyebrow, he stopped. "Forget it. That's my problem, not yours."

"Yeah, I got my own problems to worry about," Surra replied.

"Does it have anything to do with why they call you Jinx?" he asked innocently.

"Mind your own business, kid." Surra snapped.

"Magnificent, isn't it?" Surra had said the previous evening as she stood beside him at the lip of the plateau.

Taylor had been staring to the southeast. "I thought we'd see the tips of the three sisters," he indicated their direction with a sweep of his hand. "I didn't realize that they'd be below the horizon."

Surra laughed. "We're nearly thirty kilometers up, kid; completely out of the atmosphere. At this height the horizon's only five hundred kilometers away. Does that figure sound familiar?" She tried to keep the teasing note out of her voice.

Taylor screwed up his face, as if he were trying to figure out the joke. "That's half the diameter of Mons," he said at last.

"Right, and that's why you can't see the peaks of Archaeus, Arisa, and Pavonis—from here *all* you can see is Olympus Mons herself. Ain't nothing but mountain down there—she's a big one, all right."

She let that soak in for a while and then hit him on the shoulder of his suit. "That's enough sight-seeing. We need to get the bike ready for the run tomorrow." Without waiting to see if he was following she headed for the blister they'd erected earlier.

Surra removed her helmet once they had the blister pressurized. It was easier to work that way. She left the rest of the suit on for protection against the bone-chilling cold of outer space. Olympus hadn't been active for a few million years and there was no way they could gather any warmth from the vacuum surrounding her peak. The only place they could shed the suits completely was inside Bottomos station.

The research facility had originally been equipped for a staff of twenty and was now cramped with the fifty-odd racers, officials, and well-wishers that had squeezed into it for the race. With only a few square meters apiece the crowd tried to make the best of the situation; some sat talking quietly, others busied themselves by painstakingly going over their suits and gear, and some were just trying to get as much sleep as they could before the start of the race. Although there was an air of good-natured, shared competitiveness, most of the old Mars hands were very pointedly avoiding her.

"Why aren't they talking to you?" Taylor asked."Is it that jinx thing again?"

"Did you major in Asshole 101 in engineering school, Taylor?" she barked angrily.

"What did I say? All I wanted to

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know was why your friends weren't talking to you." Taylor looked all of his twenty-eight years, dewy-eyed and innocent.

Surra debated telling him about Gaspar, but held off. Too damn many ears close by to hear, too many who might chime in with their own interpretation of events that night she'd put the curse on his downhill run. Too many who'd just as soon toss her out the lock as let her in the race.

"Maybe I've got bad breath," she told him.

At that point Jack Fleth came through the lock with a big-arsed grin on his face. He glared at her and then hastened to the far end of the station.

She and Gaspar, her partner, had tangled with Fleth over who had rights to the water meteor they'd found at Petera. They'd won, but not without a brutal fight that made the lawyers rich and both of them poorer.

Fleth was canal scum, the worse of a rough bunch of rogue prospectors who'd sooner steal a claim than stake one themselves. Rumor had it that he'd had a few too many claims in places where people had caught the vacuum disease. Nothing concrete, just enough suspicion to make people uncomfortable.

You took precautions when Fleth was about.

"I'm going to check on the bike," she said casually. It was as good an excuse as any to get away from Taylor's innocent and hurtful questions. She suited up and cycled through the lock.

The blister looked untouched, but then everyone up here knew how to operate a vacuum zipper, so that was no assurance. She opened the closure and went inside.

A quick examination of the bike showed nothing obviously wrong. The locks Taylor had put on the hatches were still closed and, for the first time, she regretted calling him foolish for bringing them. The tires looked all right, not that you could harm the fat, metal mesh doughnuts. They were built to take the punishment of the sharp Martian rocks.

There was a barely noticeable coating of silvery dust on one of the struts that hadn't been there a few hours earlier, when she had adjusted the steering cable. She wiped the dust with her glove and examined the residue on the tips. It was definitely metallic, but from where? She looked about.

There, right at the point where the steering cable entered the housing, was a bright line. She placed one foot on a strut, stepped up, and looked closer.

The cable was nicked part of the way through. "Precautions, indeed," she muttered.

"Come on, Taylor. We need to go over the route one more time."

Taylor looked up at her. "We must've gone over it a thousand times already. I don't think I need to memorize every damn rock on the mountain!"

Surra looked around. "Taylor," she said through clenched teeth, "we freaking *need* to go over the stinking maps! Now, come on!" She yanked the map unit from their pack and marched toward the bathroom, the

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only place in the station where they would have any privacy. Why did Taylor have to dig in his heels now, of all times?

As soon as they were inside she shoved him onto the seat and put her face as close to his as she could. "The bike's been sabotaged," she whispered. "Somebody cut the steering cable."

Taylor started to rise but she pushed him back. "I think I know who, but I don't want him to know. He might be on his own, but could have somebody else. Either way we don't want them to know what *we* know—OK?"

Taylor nodded. There was a look of surprise on his face, as if he hadn't expected such an act. What the hell did he think this was? To a Mars rat like Fleth the fat purse *was* worth killing for.

"How long would it take to replace the cable?" she asked. "Could we do it while we are getting ready in the morning and without anyone getting suspicious?"

"Not long," Taylor answered to her first question and then screwed up his face in thought. "The fix might take about ten, maybe fifteen minutes. I designed it so it could be easily replaced. We've got spares," he added.

"Great, now we have to stay in here for a while so people will think we've been studying the maps." She shook the unit.

"Hey, I know how else we could spend the time." Taylor put an arm around her waist.

"Forget it, kid. I'm not a freaking pedophile," Surra said as she slipped from his grasp and tugged to straighten her clothing. "Come on, let's *really* look at the maps. I want to make sure you know the mountain."

"Yes, ma'am," he groaned.

Well, he *sounded* contrite enough. Damn *kid*, she thought.

"Trying to change your luck, Surra?" somebody said, far too loudly, as they went back to their spot on the floor. Surra turned with fire in her eyes, ready to blast whoever had made that comment.

The fire went out as soon as she caught sight of Sid Gammons rising to his feet. She and Sid went back a long way, before she ever tied up with Gaspar, even.

After a few hugs Sid took her back to meet Punjasuma Ramswamy, a Jovian pilot who had struck it big and was trying to find something half as interesting as Jupiter to spend his sudden wealth on. "So I'm soaking him for the bike, my time, and a share of the purse," Sid remarked as he introduced them. "Damn fool has more money than brains."

Rams laughed with them. "Jist wented to ha' de ride," he remarked with a Jovian twang even more pronounced than Taylor's. "Provide that Zid survives."

Sid sighed. "Yes, there's that. I tell you, Surra, I don't know if my ticker will stand the excitement. Too damn old for all that adrenaline, you know. Say, how would you like to take my place? Good money for you. Give you my share of the purse."

Surra smiled. "I don't think a share of nothing is worth much, Sid. Be-

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sides, I got my own crazy Jupe who thinks he has a chance."

"Not worried about the jinx, is he?" Sid asked with a smile. He'd never put much stock in that superstition.

"Not as much as some," she replied with a tilt of her head at a group of old hands. "By the way," she said with an extra nod toward Fleth, "have you checked your bike lately? Saw Fleth walking around out there earlier."

Sid's mouth tightened. "Yeah, I noticed. I hear he's still mighty sore about losing that claim fight you had."

"Grudge like that eats a man," she said. "Probably has it in for you as well, being a friend of mine and all."

Sid nodded. "I'll watch him. Think he's up to something?"

"Cut cable," she whispered. "Don't react. But check your bike real careful like, just the same."

Sid nodded. "I'll do just that."

Taylor was sleeping when she returned to their spot on the floor. His head was propped on her pack and his arms were wrapped around his own, as if it were a surrogate teddy bear.

"Just a kid," she said as she settled down beside him and rested her head on half of the pack. Taylor turned over and threw his arm across her. "What the hell," she said to herself and put her arm around him. At least they'd be more comfortable this way. Sleep came easier than she thought that it would.

In the morning Taylor seemed to have lost his give-'em-hell attitude and settled to the business of getting the bike ready. They'd struggled awake four hours before the start, thrown a high protein, low-residue breakfast into their mouths, stood in line for half an hour to use the toilet one last time, and made it to the blister with three hours left before the start.

Taylor went straight to work replacing the cable while Surra checked the seven oxygen tanks, each containing an eight hour supply, the ballast water, and the charge on the batteries. She also walked around the bike to see if any other damage had been done during Fleth's nighttime visit. Everything seemed all right.

The solar panels on the top of the blister had done their job and brought the batteries up to maximum charge, more than enough to get them down the mountain.

"Everything looks all right," Taylor remarked after he finished his own walk-around. "But let's just triple check everything to make sure we're really and truly ready."

Triple-check seemed to be Taylor's watchword, but that was good. To survive on Mars you only had to check and double-check until it was second nature. Apparently his Jupiter was not as forgiving.

Surra turned to look at the fittings on the life support one last time. There was still fifty minutes before they had to remove the blister and move the bike to the starting line. Plenty of time.

Then it hit her: In less than an hour she would be strapped to a four-meter bike hurtling down the largest mountain in the Solar System. In less than an hour Taylor's fate would be irrevocably linked to her own.

She debated telling him about her

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jinx so he'd know what they said about her. Why hadn't she told him when he asked? As if he had read her mind, Taylor looked at her with a question on his face. Was he going to ask again? Surely this was the time to tell him.

"Do you think this coupling is too tight?" he asked.

"No," she replied, losing her resolve. Maybe later she'd tell him. Much later.

"There should be some engines roaring," Taylor said jokingly as they listened to the countdown that would start the race.

"Be quiet," Surra shot back over the intercom. "I want to hear the count."

"Three minutes," the radio squawked.

"Remember, we go straight down for the first ten kilometers," she reminded Taylor. "There will be a big fissure on our left when we have to make that sharp turn. I'll tell you when to start the turn to the north."

"We've been over this a hundred times," Taylor complained. "I think I know the route as well as you." The kid could be a real jerk at times. Didn't he know nerves when he heard them?

"Just the same, don't get creative or we'll both be in trouble. I know the old bitch better than anyone. You wait for my directions, you hear me?"

"Yes, ma'am," he said sarcastically. Apparently she wasn't the only one with a bad case of nerves.

Surra listened as the count headed toward the sixty second mark. "Sixty-four, sixty-three, sixty-two. One minute!"

"Charging!" Taylor barked, all business. Surra checked her harness to make sure the straps were tight. If Taylor's capacitive shot to the high torque motors he'd installed worked as promised, she'd be in for a helluva jolt.

She glanced at the bike on their right. Externally, It wasn't much different from theirs. All of the entries in the race were modified three-wheeled prospector bikes. The riders on the one beside her sat in the saddle on top, where the prospectors normally rode, one behind the other. Taylor had shown her the drawbacks of that design; it gave you better visibility but made the center of gravity too high at the speeds they'd be using. That could be dangerous in a tight turn.

Taylor's modified bike—she could not bring herself to think of it as hers—used a side-mounted configuration with him on a outboard cradle on one side and her on the other. Because of the limited visibility this gave them, the only way they could communicate was through the intercom.

"Thirty-two."

Damn, she shouldn't be wool gathering at this point. She activated the map display in the inertial with a thick-gloved finger. The color screen came to life immediately, their current position atop Olympus marked with a bright red dot and the track they'd planned a yellow line. The inertial would have been a handy gadget to have a few years back, when she'd been prospecting in the wastelands, she thought. But she couldn't have afforded it then, any more than she could now. Damn rich kid! What did he know about Mars?

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"Twenty-five."

What was she doing here, Surra asked herself for the hundredth time. Taylor could have bought a full year of her family's services for the price he'd spent on this stupid race. What the devil were all of these idiots trying to prove, anyway? With most of Mars's prospectors struggling to earn enough to pay the exorbitant fees for the oxygen and imported water, this race seemed a ridiculous waste of money and resources. But the government said that it put new capital into Mars's marginal economy, and that was good. Hell, anything that would improve the lousy economy was good! Maybe it would even improve enough to get her damn sister off her back.

Most of these racers were in it for the glory, she knew. Big fucking deal; beating the forty-eight hour record for the run from Bottomos to Rescue Point. The other record, the one nobody liked to talk about, was ten idiots killed trying to do the same thing. Her first husband had been one of them.

"Eighteen," said the radio. Why was time dragging so slowly? She felt her blood surging in her ears and heard the air rushing into her lungs. Every sense was heightened, every detail stood out in sharp detail.

"Tennineeight."

How had the time gone by so fast? The adrenaline was flowing now. She could feel her heart rate shoot up. Her palms started to sweat. She braced her feet against the stops near the back of the cradle.

"Brakes off!" Taylor shouted through the intercom, loud enough to make her ears ring.

"Five."

"All secure," Surra said curtly and braced her chin against the helmet's padded collar.

"Three!"

"Applying power," Taylor reported, sounding calmer now. He'd said that it would take three seconds for the capacitor to charge up from the battery.

"Two!" Surra held her breath.

"One!"

"Ya-hoooooo!" Taylor shouted as the bike leaped forward.

Surra hadn't heard the start count clearly enough to know if they had gotten off properly. If Taylor's calculations had been correct the capacitor should have discharged across the motor, spinning the drive wheel up to 6,000 revs in an instant.

The bike screamed off the starting line and, throwing a stream of pebbles and dirt behind them, hit the gentle slope thirty meters away, beyond the edge of the caldera. It bounced twice and then pitched to the right. By the time Taylor got the bike back under control two other bikes had dashed ahead of them.

"Damn!" he exclaimed. The speed increased and settled into a rattling, shaking, bone-shattering ride.

"Don't worry. She'll settle down in a bit," Taylor shouted and, true to his word, the bike did.

Now it was only rattling and bone-shattering.

The slope at this level was the youngest part of the mountain, the most recent lava flows. Most of the surface was hard, bumpy rock. They

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wouldn't encounter any change in the scenery for another twenty bruising kilometers.

Soon the leading bikes started to turn to the left. "Follow them," Surra instructed. "You'll be able to see the fissure's edge in a minute." No sooner were the words out of her mouth than the northern edge of the first transverse rima appeared. The leaders of the pack were already swinging to avoid the second one.

"Watch it!" Taylor swerved the bike to avoid a broken slab that appeared in front of them. She glanced back and saw that most of the bikes behind them did likewise. One didn't, hit it, and spun out of control, throwing its riders. Surra said a brief prayer for them. A smashed helmet in this vacuum was an instant death sentence. Farther down, where the atmosphere was thicker, you could survive for maybe a minute longer than instantly—faint comfort in either case.

They were now moving down a fifteen degree slope that was relatively clear of debris, moving at about thirty or forty klicks, just on the edge of too damn fast for safety and a hair slower than the leaders of the pack.

"Stay back. Don't try to keep up," she reminded Taylor. It would be just like the kid to be so pumped that he'd forget her insistence on caution.

"Right," he said, too sharply. Apparently, steering the bike was taking a lot of his attention. Their practice runs earlier in the week had shown how unforgiving the bike was, despite Taylor's claims of increased stability. Prospector's carts were never meant to race; they were designed to carry a couple out on the desert and back. They hardly ever moved faster than ten, fifteen klicks. Mechanical burros was all they were, not thoroughbreds!

Surra finally got used to the swinging rhythm of the bike as it bounced over the rough surface on its fat, limber tires. The pack was staying pretty close together, with no clear leader as yet. That would change in the next hundred kilometers, when everyone started to maneuver to avoid the rougher ground farther down the mountainside.

"Next turn coming up," she told Taylor as they approached a bright orange cone someone had placed on the bare rock.

"I see it," Taylor said and took them in a banking turn to the right, right on the boundary of too reckless, she thought. "Be careful," she warned.

"Don't worry," Taylor responded with a laugh. "I've designed this bike to be stable on the turns."

A few kilometers farther and the front group of bikes started to turn again. Taylor continued beyond their turning point and then, when he noticed that they'd overshot, turned sharply. Immediately Surra's side shot up as the bike tilted hard to the left.

"Don't turn so damn sharp!" she barked. But her warning was too late. The bike slewed around, spinning one hundred and eighty degrees. At the moment Surra thought they were going to tip over the bike slammed back down with a teeth-crunching shock.

"Sorry," Taylor said calmly as he took the bike into a broad turn that

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put them at the rear of the pack. "Takes a little getting used to," he explained.

"I told you and I told you; don't take sharp turns. Weren't you listening to me, damn it!"

"I said I was sorry," Taylor repeated. "How soon to our next turn?"

Surra glanced at the inertial. The red dot showed them about ten kilometers from the spot where they would leave the main route to go on a different course. "Twenty or thirty minutes. We need to make up the time we lost back there." The bike shot forward before she completed the sentence.

The ride became easier as the surface changed from the younger to the older flow material. The ground here was still hard rock, but more heavily pocked with small craters.

Surra hung on and prayed that Taylor wouldn't hit one of them.

They had caught up to the rearmost bikes when they neared to their departure point. "Start heading south and take the turn nice and easy," she told him as he did so. "That way they won't notice that we've left the main route . . . Shit!"

"Yeah, I see him too," Taylor replied. Ahead of them an orange bike had turned parallel to their heading.

"Why did I think that we could get away with this?" she said bitterly. "I didn't figure anybody else would have the guts to follow, even if they did see us."

"Well, it looks we're in a real race, now," Taylor replied. "How close are we to your mine?"

"Another five klicks. There's going to be a cairn close by; pile of rocks about one meter high."

"Claim marker?" Taylor asked.

"Grave," Surra said, biting off her words. "Stupid jerk who thought he could beat the mountain."

"Friend of yours?" Taylor asked, and then added, with surprising compassion. "I'm sorry."

"Don't be. We were only partners for a few years. No great loss." Taylor didn't respond, which was a blessing. She'd hate to have to explain why she'd said that.

"There it is," Taylor said unnecessarily as the cairn came into view. "Right turn?"

"Right turn indeed, Mr. Blacker," she replied in as bantering a tone as she could muster. She'd only visited the grave once since Gaspar had died, and that was only to get his ID so she could claim the oxygen debt they owed him, the bastards.

"Look carefully. You should see the ramp we made somewhere along here." She watched the landscape carefully.

"That's the spot," she said when it came into view. "Damn!" She spotted the orange bike swinging toward them, right on their tail.

Taylor headed straight for the ramp without any further guidance from her and slowed as they approached the edge.

"Looks like an easy slope," Taylor remarked. They flew down the broken rock to the bottom and, as soon as they were clear of the shattered gray talus, Taylor turned the bike to follow the fissure's floor as it jigged back and forth.

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"Keep your eyes open for that setback," Surra prodded with one eye on the glowing map display.

"Are you sure about this?" Taylor asked.

"Absolutely," Surra said positively. "Gaspar and I were the last ones to prospect this area. Nobody else was fool enough." The dot in the display touched her small red tic mark. "Wait; we're real close now. Right on top of it, according to your gadget! See anything on your side?"

The brakes slammed down so suddenly that she slid forward and hit her shoulder against the rim of the cradle. Before she could shift herself back into position, Taylor was already backing and turning to squeeze the bike into the narrow passage that ran back to the north at an acute angle to their original course.

They cautiously steered the bike down the narrowing chasm, alternating steering control to whoever had the best vantage for that leg.

"Are you sure we won't get stuck?" Taylor sounded worried as they passed through a particularly narrow passage.

"Trust me," she replied through clenched teeth as the edge of her cradle scraped the nearest wall.

Finally, just as the passage looked as if it might end there was the steep talus; a ramp of loose rock that had been dislodged from the shattered wall of the fissure. She could just glimpse the sinking Sun, a tiny disk against the star-studded black sky, above the edge. That meant that they had another six hours of "daylight" left. Taylor had no problem driving the bike up the slope and onto the flat plain above.

Surra looked around. The landscape was flat enough that she could see at least five kilometers away in every direction, except left, where the bulk of the bike cut off her view. There were no other bikes in sight. Had the other bike found the set back so they could also make use of the hidden exit or was it now trapped in the fissure?

"Straight southeast for the next sixty klicks," she instructed after Taylor had put them back on the right heading. "Keep an eye out for that bike that followed us," she suggested.

"Might be something way up north." he replied. "I see something shining. Could that be them?"

"I doubt it," she said. How could the orange bike have gotten north of them? That didn't make sense. "But keep your eyes open, just the same." She resumed her own watch.

A few kilometers beyond the fissure the surface suddenly changed back to the rough, hummock dotted, younger lava shield. Taylor pushed the speed up. "Don't get overconfident," she warned. "This is only easier for a little ways."

Since there was no major geology to worry them for the next thirty klicks, she lay her head down to get some rest. "Tell me when you're ready for a break," she reminded him. "And keep your eye on the map display. Don't want us getting lost up here," she added humorously.

Their plan was that she should rest first and then take her turn steering. Taylor would rest until they hit the

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next fissure so he could take them through it.

And so to sleep, perchance to dream.

Taylor sang a few bars of Danny Boy. His nice tenor voice came across badly on the intercom. Surra snapped awake as he sang ". . . The pipes, the pipes are call-all-ing . . ."

"I told you to hook up the relief tube before we started," she joked as she took a sip of water from the nipple in her helmet to clean out her mouth. The light was becoming a little better. There was just enough atmosphere around them to scatter the weak rays of the late evening Sun and soften the edges of the shadows on the rubble-strewn plain. At this part of their chosen route the bike was back on the older shield material, stuff that had been bombarded by space junk for millennia. Craters and shattered shards were all over the place.

Taylor laughed. "Time to take over the reins, ma'am. Be good to her." Surra could hear the tiredness in his voice.

She wrapped her gloves around the wishbone steering yoke. What with the restrictions of the suit and straps, there was barely enough freedom of movement to twist it half a turn right or left. "Got it!" she said as she felt the bike's vibration on her hands through the yoke. "You can get some shut-eye now."

"Zzzzzzz," Taylor replied. Despite herself, she laughed. "Night, night."

Taylor must have been running on adrenaline as well, for his snores came over the intercom moments later. When her husband had done that she'd poke him to roll over. Couldn't do that here, with two suits, and the bulky body of the bike between them. Besides, with all the straps on Taylor, he couldn't roll over anyhow. She keyed the intercom's volume down and paid careful attention to the rough ground ahead.

The Sun angle was low enough to highlight the larger meteor dings in the scarp. Their bike just rolled over the smaller ones, bouncing a little as it did so, a gentle rolling motion. When the Sun dropped below the horizon she'd have to slow down so she wouldn't overrun their lights.

She glanced at the map display. They were ahead of their planned time. Taylor must have really pushed them while she rested, probably faster than he should have. Must be that Earth background; most prospectors would be more cautious, more careful—there were too many cairns to those who weren't.

Like the one they'd passed.

Why had she shut Taylor off when he asked about Gaspar's cairn? The kid was just trying to be friendly; like when he asked her about the Jinx nickname. Shit, why hadn't someone warned him back in Jovus? The other prospectors would have told him about the risks of teaming with her; told him how her men had a nasty habit of "contracting vacuum disease," and then laugh self-consciously afterwards. Personally, she didn't see the humor in it.

Why hadn't Gaspar been more careful? They'd had some strikes, like that water meteor they'd found at Petera

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Major. That strike had set them up with enough to pay for a bike, oxygen, and water for a year. Gaspar had a hell of a party with his part of what was left over, while she contributed her share to her sister's family—their mine was in trouble and sis needed the money for the taxes, or so she'd said—so no party-time for Surra. The bright side was that *she* didn't have a hangover when Gaspar and she had pushed up the mountain a few days later, him holding his head and groaning the entire way.

But water meteors aren't that common and the partnership with Gaspar ended up where it began after just ten months; nearly broke. She'd wanted to use what was left of their money to check out the Maternis lode. Rumor had it that prospectors were finding iron-rich ore down there and making good money.

Gaspar hadn't agreed and wanted to give Olympus another chance, stubbornly insisting there were hidden riches to be found. He'd made a stupid bet that he could beat the record on the Chu San run to raise a stake; their bike against the cash. She swore and cursed him, swearing that she was going to go to Jovus with the pack train and arrange for their trip.

"I ain't going to Maternis," Gaspar had declared. "You'll see; I'll be waiting at the Point for you," he boasted. "Won't have any problem with money once I break the record!"

"You are an idiot, a fool, and worse," she'd said. "If you're that stupid then go ahead; but leave me out of it!"

"Wish me luck," he asked with a smile and spread his arms to hug her.

"Screw you," she said as she pulled away. "Go ahead and kill yourself!" she screamed bitterly. "I don't care."

The other prospectors had heard that. "Bad luck," they'd said. "You'll jinx him."

"Superstitious nonsense," she'd replied. "The only jinx he has is his own stupidity!" she said angrily and stomped out to jump the pack train down to the Point.

When she got to Rescue Point a week later Gaspar wasn't waiting for her. She'd taken a burial party up to find him, there being no reason to expect that he could be alive, since the bikes only held a couple of day's air and his couple were long gone.

They found him cracked up at the bottom of a deep fissure. "Jinxed him," the other prospectors had clucked and edged away from her.

"Superstitious nonsense," she protested as they buried Gaspar under a cairn. His suit and gear got her enough money for a ticket to Maternis. The bike was scrap, but they took it anyway—he *had* lost the bet.

She caught a glimpse of something moving on her right. When she turned she saw the orange racer. It came closer and closer.

Surra looked down and saw that she'd allowed their speed to drop. They were nearly on schedule. Damn, she'd lost all the lead that Taylor had gained while she was resting. With a conscious effort to overcome her caution and good sense, she pushed the speed up to thirty-five klicks and watched the orange vehicle drop behind. Yes, the bike handled nicely at

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this speed, Why had she been so reluctant to believe Taylor? She pushed the speed up another few klicks.

The Maternis ticket money had gone to her sister and that worthless husband of hers. Their stupid little mine had finally played out and neither of them would stoop to take a job with the Earth corporations; something about his Martian pride, sis's husband had declared haughtily. Well, their pride hadn't made them refuse her ticket money, had it? But, what could she do? They were blood, and family shared. Even Taylor knew that.

After that it was hard-scrabble for anything touching on income, and half of everything went to her sister. Not that she made that much, what with the jinx thing dogging her. Damn lucky for all of them that Taylor had come along when he did, trying to prove himself to grandpa.

What was it he had said about his great-great-grandfather? Something about him flying in a hurricane, whatever that was. Growing up on Mars she hadn't the opportunities that the Earth-born enjoyed; things like wind, open skies, fresh air that didn't taste of silicon grease, food that didn't come out of a processor, and filtered water that hadn't passed through your kidneys, and others, a few hundred-thousand times. A hurricane was another of the experiences she hadn't enjoyed.

Why the devil did Taylor think he had to prove anything? Didn't he already have everything anyone could want; money, good education, great career, and, from what he had said, a family that wasn't a bunch of whining losers and assholes. Not at all like hers.

Suddenly the orange bike was beside her and closing rapidly. She risked a glance and saw two figures in the saddle. One of them, who wore what she thought was Fleth's checkerboard shoulder pattern, waved something over his head. From this angle she couldn't tell what it was.

They were just entering an area of heavy flows. The fluid lava had flowed quickly over this section, forming waves that solidified into an undulating surface. Surra pushed the speed up and raced up the leading edge of one such wave only to have the bike leave the surface and fly a short distance before coming back down in a surprisingly gentle landing on the reverse slope. She cut the speed back, not wanting to risk such a foolish trick again.

The orange bike pulled beside her, only this time it didn't try to parallel her course but seemed to be moving on an intercepting path. Closer and closer the side of the orange bike came to hers.

Then she realized what they were trying to do—crush her cradle between the two bikes. Sitting where she did, low on the side, and them atop the other, only she was in danger from their maneuver. She turned the bike away from them as they both topped another wave.

The orange bike was relentless and again drew closer, forcing her farther and farther to the side as she evaded them. She knew that these gentle waves converged into a narrow defile just a short distance ahead, a passage

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only wide enough for a single bike. Perhaps they just wanted to beat her to the defile, to slip through and gain the lead. If so, then she would let them. It was a straight shot back to rejoin the main path from there.

With a sudden twist of the yoke she turned away, slowed. and dropped behind the orange bike, watching it pull ahead and away. Let them think she was just taking a short cut to the main route, she thought. If she let them speed ahead maybe they wouldn't notice that she was going in a different direction, a second short cut that was on the yellow line of the inertial instead of racing for the main route.

The waves of hardened lava began to close in as she approached the entrance to the defile. Apparently the orange bike had already gone through, for it was nowhere in sight. She headed into the narrow passage and increased speed, hoping to regain the lost time.

What was that? She was making a slight turn in the narrow defile when something suddenly appeared directly in front of her. She quickly yanked the yoke to the left to avoid it, but it was too late! The drive wheel struck with a sickening thump that sent the bike tilting precariously to one side as it ran up the side of the hill.

Taylor came awake with a start. "What the hell?" he started to say as the bike slammed back onto the ground and drove his teeth through his lip. Then the bike tipped in the opposite direction and lifted him up, up, and up until . . .

. . . It slammed back down and came to a halt. He heard the sound of escaping air and saw that all of the helmet's tell tales were in alarm red. No cracks that he could see, so his neck seal must have jarred open from slamming against the cradles' side. He took a deep breath then blew all the air out of his lungs before he twisted the helmet to one side, lifted it to clear the gasket and then replaced and sealed it with a quick clockwise twist. The tell tales went green. As he'd suspected, the shock had just unseated the seal, was all.

But why wasn't the air filling his helmet? In rising panic he checked the supply hoses. Both appeared to be all right. Quickly he unstrapped himself and scrambled up the side of the bike to reach the connections. He felt for the valves. They appeared to be secure.

His ears started to ring, the first sign of oxygen deprivation. With a practiced motion he switched to his suit's emergency bottle and took a deep breath of the welcome flood of oil-flavored air. The bottle would keep him breathing for two hours, at least.

"Surra?" he yelled. "Surra, what happened? Are you all right?"

There was no reply. Fearing the worst, he forgot his air problem, climbed down, and raced around to the other side of the bike.

From what he could see, Haley's helmet appeared to be intact; all her lights were green. There were no other signs of damage that he could see. He reached out to shake her shoulder.

Surra jumped as if he had shocked her. She twisted her head to look up at him. Taylor could see her lips move, but heard nothing. Damn, of

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course, how could he with the intercom disconnected? He switched on his suit's radio. "Are you all right?"

"We hit something back there. Didn't see it until we were right on top of it. Oh my lord," Surra exclaimed and pointed toward the rear of the bike.

Taylor turned to see a plume of steam spraying from the rent in the fairing. "Fire?" he asked in a panic. No, that couldn't be right, not in the near vacuum. But what . . .?

"It's the ballast water!" she exclaimed.

A prospector bike normally held two hundred liters of water, enough to supply prospectors for the few days they'd be in the desert. Taylor'd filled the tank to capacity so they'd have the added weight for stability. When they got to the lower plains, where they would need the flat-out speed, he would vent it, lose the weight, and improve performance.

But now that the water was boiling away they would have to do without, which meant being a lot more cautious on the turns.

"Bad, but not a catastrophe," he said with resignation. "We can do all right without it."

He waited until the plume stopped and then walked to the rear to examine for further damage, checking the frame as he went. One of the side struts was badly bent and stuck out at an odd angle to the direction of travel. The radio dish had been ripped off and lay forty meters away. Its coaxial connection had been pulled completely out of the fairing and the torn end of the cable dangled uselessly, which meant that the dish was so much scrap metal, not worth repairing. There seemed to be no other damage that he could see.

The steam had come from a deep rent near the life support area. Looking inside, he saw a glint of rapidly sublimating ice where the water line had been torn. He opened the cover hatch. Just above the place where the line was severed were the broken pieces of the multi-tank oxygen regulator. Whatever had struck the line had sheared it off and vented not only his air, but the other two bottles—sixteen hours of air—as well. A quick check showed that they had lost half of their air tanks. A few centimeters farther and they would have lost the other four tanks as well.

"Look here!" Surra's shout over the suit radio startled him. He turned around to see her holding out a large, wickedly bent piece of metal.

"Where the hell did that come from?" he wondered angrily as he turned it over in his hands. "It looks as if it had been machined yesterday!"

"Hard to tell. It could have been out here for years without changing—no weather, you know." Surra didn't sound convinced, but didn't explain further. "How's the bike?"

"Well, the running gear looks like it's all right, but I'm afraid that we lost quite a bit of our air. We broke one of the regulators when we hit," he explained. "My side of the bike can't use the tanks."

Surra looked into the compartment. "We'll have to split the other tanks between us," she said, and, matching actions to words, cross-connected their

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air supplies with one hand.

"What's wrong with your arm?" Taylor asked.

Surra shrugged. "Think I broke it when the bike skidded. Didn't have my straps tight enough, I guess. Hurts like hell, but I can hold out until a rescue team can get here," she said as she finished.

Blacker pointed at the missing radio dish. "No way to call for help, Surra. The only way we can get more air is to reach Rescue Point."

"That's still thirty-some hours away, even if we make the time you wanted. Shit! What do we have left?"

"We've got a little more than four tanks left," he said calmly. "But with two of us sucking on it we won't make it in time. Not both of us."

"So only one of us can make it to Rescue Point?" she asked flatly. "Want to flip for it?" she added and laughed nervously.

Taylor looked at her. "Didn't you say that we could cut off some more time if we crossed that steep lower set of fissures?"

Surra paused. "Nobody's ever done that," she started to protest. "Besides, that way's a lot riskier, especially with me not being able to drive. But what the hell; I guess that's a better option than flipping coins to see which one of us can learn to breath vacuum. Let's go!" With that she climbed carefully back onto her cradle and allowed Taylor to strap her in.

Taylor returned to his own side and secured himself, shutting off his suit's bottle and reattaching the air lines. He started the bike moving the instant he was done.

What had they said about her being a jinx?

The ground had leveled out even more as they flew down the mountain, with the hounds of urgency nipping at their heels. Although he tried to stay calm, Taylor was close to panic. Each breath was a debit to their precious air, air that could not be replaced.

He cursed himself for his stupidity. What had started as a way of impressing his family had turned into a race for survival. It was amazing how his priorities had suddenly changed. Breaking the Chu San record suddenly became of secondary importance, if that high.

Damn, why had he let Surra talk him into going off the usual route? If they'd stayed with the others someone would have seen their distress and radioed for help. Why hadn't he been more cautious, more concerned for what might happen? Of course, had they done that, they wouldn't have hit the metal scrap. But *why didn't* wasn't a productive line of thought. He tried to think of something else.

Why, he reflected as he steered the bike around the frequent craters and scattered rocks, was this race so important to him? Was it all ego? If so, then he'd put two lives at risk for nothing. What a fool he'd turned out to be; trying this stupid, adolescent stunt to win the approval of his family, trying to prove that he was the equal of his father, his grandfather, and all of his greats.

He turned the bike to the right to

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avoid a moderately-sized crater and the bike started to swerve. "Careful," Surra advised, "without the ballast we can't take the sharp turns."

"Right!" he bit back.

Was she angry at him for forcing her to come with him? Sure, she'd had the choice of refusing him, but with her financial situation had there been any *real* choice? No, he'd seduced her to this stupid race with money and the promise of the bike. Damn it, what had he been thinking? Did the approval of his family mean that much or was he just trying to prove something to himself?

Regardless of whichever it was, he wasn't going to let this woman be sacrificed for the sake of his ego. He'd been a self-centered fool for trying this, ignoring the effect his own actions would have on others. When they got to Rescue Point (not *if*, but *when!*) he was going to call his father and grandfather and then tell them to get the hell out of his life. That's what he was going to do!

The subtle changes in Olympus Mons's surface came and went as Taylor drove into the long Martian night. He pushed the speed as high as he dared, balancing the need for speed against the need for safety, always running at the limits of his headlights. When morning came, he hoped, he'd be able to go faster. The night wore on as the red dot crept farther and farther from the planned yellow line, going straight down the mountain.

Morning brought the rising of the singularly bright star that was the Sun. The thickening atmosphere scattered her golden rays across a clear, deep violet sky. That color would change as they descended. At this time of year, when the dust storms swept the central latitudes, the sky down on the plains was usually a dusty rose at the horizon, fading to yellow-brown overhead.

The ground was becoming rough; dotted with scattered boulders that threatened to tilt the bike over more than once. There was a slippery coating of dust over the smooth, hard rock that made the steering treacherous.

Taylor hadn't imagined that he could get exhausted so quickly. He'd been running for sixteen hours since the accident and was starting to tire from the strain. Surely it was the adrenaline-pumped tension of watching the landscape for axle-breaking potholes, rocks that could capsize them, and sudden dips and cracks too small to have shown up on the photomaps but still large enough to catch a wheel and give them a nasty, deadly spill. Lord, he wished he'd paid more attention to the smaller details.

"How are you doing?" he asked over the intercom. Surra had been silent for hours. He hoped that she was resting, conserving their precious oxygen supply.

"Isn't easy to rest. Arm hurts every time you hit a bump."

"Sorry. Do you want me to get back on the main highway?" he joked.

"Naw, let's enjoy the scenic route instead," she replied. There was a long silence. "Taylor," she said at last, "it just might be true, you know."

"What is?"

"This jinx thing. I mean, first Ed's death, all the bad luck Sid and I had, then there was Gaspar's accident."

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She explained the source of her nickname in a few terse, emotionless sentences. "Two dead partners sort of sets the pattern, don't it? Now it looks as if you'll be another one added to my score. Hell, maybe *I'll* be the final entry myself—a fitting finish, wouldn't you say, kid?"

When he didn't reply she continued. "Then there's my sister. Every time I try to help her she gets into more trouble than before. Shit; she lost the mine because I didn't give her enough money to cover the debt."

"Was that your fault or hers? I mean, if you were helping her, why was it your fault?"

Surra was silent as she considered his words. "I don't know. I guess I've always felt responsible for her, like I had to protect her after dad and mom died. 'Course, she didn't pay me much mind when she married that damned no-count husband."

"So she has a husband as well? Lord, Surra, why do you take so much on yourself? Sounds to me as if you've been the smart one in a bunch of astoundingly selfish people."

"Hey, that's my family you're talking about," she laughed. "Yeah, I know you're right, but what can I do? They're family."

It was Taylor's turn to laugh. "Family! Boy, do I know that. Easy for me to tell you to separate yourself while I can't do it myself. Gramps and pop still control me."

"I think you love them as much as I do my sister," Surra suggested.

"Yeah, you may be right." Strange that he had never thought of it that way. Love—what an idea.

* * *

There was an occasional puff of dust that indicated that they were in an appreciable atmosphere at last, at least enough to support a light wind. It still wouldn't do them much good, considering that Mars reference level atmospheric pressure was close to a vacuum as far as they were concerned—and they were still far above a reference level that was only 1 percent of Earth normal.

The edge of a wide fissure appeared ahead. "Wake up, Surra," he shouted over the intercom. "Here it comes."

"I see it," she replied. "God, it looks bigger than I thought!"

"Where's the best spot to go down?" he asked as they raced toward the edge.

"The sides are really steep," she said slowly, as if trying to remember. "Nearly sixty degrees most of the way. There's a more gentle slope up ahead, but the bottom's pretty tight there. We could get stuck."

"Not much of a choice," Taylor replied. "Let's chance the steep grades and try to keep from tilting over."

"Whatever looks good to you," she said. He could hear the edge of fear in her voice.

"This spot looks as good as any," Taylor said and turned the bike.

The lip passed beneath the nose of the bike and, for a heart-stopping instant, all he could see was the distant, opposite bank and the huge emptiness that loomed beneath. The nose of the bike dipped sickeningly onto the steep slope.

Then they were racing pell-mell

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down the slope, the walls of the canyon whipping by at ferocious speed as the bike rocked from side to side. There was a sickening lurch to the left and, as the bottom rushed up, he fought the steering yoke to keep the bike upright.

The impact slammed him against the side of the cradle, making him see stars. Surra screamed over the intercom.

"Are you all right? Still with me?" Taylor shouted as he fought the wheel.

Surra cursed in a steady stream for long minutes. "You did remember that there are *brakes* on this bike, didn't you?" she said nastily.

"Now where do we go?" he demanded. "Come on, we've only got a few hours left!"

"There's a grade you should be able to climb about four klicks ahead. The bottom is pretty smooth up to that point."

"This is smooth?" Taylor answered incredulously as the bike shook and rattled its way along the rock-strewn bottom.

They were making a steady ten klicks, hardly a good walking pace, but necessary if they were to avoid the larger rocks. Taylor grew impatient at their slow progress.

"How about there?" he said suddenly and turned the bike toward the far wall.

"Wait!" Surra exclaimed as Taylor blasted the bike up the hill.

The front wheel dropped over the lip as the bike started to drop. All that Taylor could see was the emptiness beneath the bike's nose. The bike rocked back and forth on the knife edge. He had managed to brake in time to avoid a fifty-meter vertical drop.

"Don't . . . ever. . . do. . . that . . . again!" Surra panted.

"Yes ma'am,' he replied, trembling with fear of their close call, and threw up in his face mask.

After cautiously returning to the bottom, they carefully crept along to the five hundred meter slope Surra had mentioned. It ran up to the plain on a breathtakingly steep angle.

"The only way out is to traverse it," he said after studying the bank for a few minutes. "Cut back and forth."

"Can you do that without tipping us over?" Surra asked with a worried note in her voice.

"I think so. The wide track of the wheels and low center of gravity should hold us to the slope. Turns will be a bit touchy, though. Hell, can't be worse than climbing the fissures on Io."

"Well, what are you waiting for?" she asked without hesitation. "Let's go for it."

Taylor attacked the slope on a shallow angle, heading toward the west at first then turning the bike directly uphill momentarily before heading back to the north. With each turn the bike rocked on the edge of tipping over backwards, the front wheel lifting slightly, losing a bit of traction on the hard surface of the slope.

Back and forth, back and forth, back and forth, each traverse gaining them a few vertical meters on the slope. Taylor shook his head to clear it, knowing

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that any loss of concentration on his part could kill them both. Now that they were three-quarters of the way up a tip-over would send them plunging back to the bottom, a tumble that neither of them would survive.

"One more turn," Surra cheered him on. "We're nearly there!"

Taylor made the final turn and gunned the motor to drive the bike over the lip of the deep fissure and onto the flat, dusty plain. The Three Sisters—Archaeus, Arisa, and Pavonis—came into view as they emerged.

"Turn northeast about twenty degrees," Surra shouted, "and gun this son-of-a-bitch!"

Taylor needed no prompting and sent the bike surging forward at fifty klicks. By his estimation they only had an hour's worth of air left and Rescue Point was nearly a hundred kilometers away.

They weren't going to make it.

Olympus's lower levels were covered with dirt and small rocks. Down here even Mars's weak weather had smoothed out the rough edges of the volcano, filling the craters with sand, thermally fracturing the rocks into smaller pieces through the seasonal freeze and thaw cycles, and generally making the lower skirts of Mons a less forbidding place. The bike rode easily over the relatively smooth surface.

"I've been thinking," Surra said suddenly. "What if we started broadcasting a mayday on our suit radios? Maybe someone will hear us before we get to the finish line."

"Great, we'll do that as soon as we get within range—about fifty kilometers, I'd guess. Another hour, at least."

"We won't make it, will we?" Surra said calmly.

"We *might* have enough air. My guess wasn't that scientific, you know."

"Then again, we could have a lot less," she countered. "My jinx, y'-know."

"Stop that! You got us this close through intelligence and knowledge of the mountain. Luck hasn't had a damn thing to do with it!"

"And you did it yourself as well," she shot back. "I didn't see your family helping you back there!"

"Know something? I think I just realized that what my family thinks of me doesn't matter a bit. I'm doing this race for myself after all, for the acclaim it will bring. Yeah, and maybe, some day, I'll tell gramps about it."

As Surra broadcast their mayday Taylor concentrated on getting every erg he could out of the bike's batteries, pushing the motors to their design limits, and beyond. The bike bounced unmercifully whenever it hit an outsized rock, forcing a muffled scream out of Surra, but that was better than slowing down and losing precious time. Every second saved put them that much closer to safety.

"No response," Surra reported as he steered the bike along a narrow chasm formed by ancient, massive folds. "The hills ahead might be shielding us," she suggested. "They run for another twenty klicks. I'll wait until we get clear before I start shouting again," she said, and then added, "Cutting it pretty close, aren't we?"

"Maybe. How long do you figure

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we can breathe the stale air in our helmets after the air runs out?"

"Three to five minutes is all, by then the carbon dioxide buildup gets us. Say, don't we have an hour or so in our suit bottles? Hey, maybe we can make it after all!"

"Good going, lady. But keep broadcasting just the same." He didn't remind her that he had used up half of his bottle already. Even optimistically, he'd be a half hour short of rescue.

"Surra," he said at last. "Could you steer with one arm?"

"I guess I could if I had to, but it wouldn't be at this speed. Why do you ask?"

"No reason." He hesitated. "But if anything *were* to happen to me, you'd be able to make it to Rescue Point, wouldn't you?"

"What the hell's going on Taylor? What are you trying to tell me?"

"I might need to take a rest when we get out of these hills, is all. Pretty exhausted. Don't know if I can drive much more." He hoped that explanation would satisfy her.

"You are full of crap. Remember what I told you about how I feel about liars? Still holds, kid. Come on, what's the problem?"

Briefly Taylor told her about his estimation of the air supply and the status of his own suit bottle. "So you see, you'll be able to make it, even if I can't."

"Well, let's pray that it doesn't come to that," she replied. "Say, can't you make this buggy go any faster?"

Taylor pushed the bike to sixty and watched the scenery flash by. Was it his imagination or was the air already starting to get a little stale?

Twenty minutes later he knew that the air was definitely getting stale. He decided to hold off using his suit bottle until he absolutely had to. Breathing began to come harder and he felt himself growing more drowsy. It would be so nice to close his eyes and take a brief nap that . . .

"Taylor!" Surra shouted. "What the hell are you doing?"

"Huh," he opened his eyes.

"The bike's swerving like mad. Use your suit unit. The bike's air's gone now. Come on, Taylor, talk to me!"

He twisted his suit's valves, took a deep breath, and felt the fresh oil-tainted air flush his system. "Thanks, almost fell asleep there," he admitted. "Be ready to take over the steering in about twenty minutes. I figure that's all I have left."

"Listen to me," Surra said calmly. "I'll take over right now. The arm doesn't hurt that much any more. Shut your supply to half and let yourself go to sleep. You won't burn as much oxygen that way. That will stretch out whatever you have a little longer."

"Waste of time," he said groggily, but did as she instructed. Sleep came instantly.

Someone was shaking him vigorously. "Come on, wake up," Surra said. "Damn it, kid; talk to me!"

Taylor realized that she was sitting on his back, straddling him with her knees. A flood of fresh air was flowing into his helmet. "What happened?" he asked.

"Decided we'd finish this race together or not at all," Surra replied.

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"Hooked you into my suit so we'd share whatever's left. Now come on, Rescue Point can't be more than a few kilometers away."

Taylor didn't argue, but he thought it was probably the most idiotic thing she had ever done. Now they were both doomed. Nevertheless he pushed the bike forward at max speed.

They popped over the last ridge and started down the long slope to Rescue Point. As they came nearer he saw a small caravan of bikes heading toward them. "The rescue squad," he gasped.

"Remember how I said we could survive about five minutes after the air ran out, didn't you?" Surra asked calmly.

"Yeah, but they're only a few minutes away."

"I think we can make the finish line on what we have left," she said in a rush. "Do we go for it?"

"Why the hell not?" he replied. "Yeah, let's go for it!"

Taylor raced by the shocked rescue party and headed for the entrance to Rescue Point lock, the finish line. There were no other competitors in sight. Taylor looked at the clock as the Point's lock cycled and realized that they had done the entire run in little over forty-three hours.

"We've broken the record, Surra!" he said wearily. "We've done it! We beat your jinx!" There was no answer. Her body fell limp from his back as he turned.

One glance told him what had happened: she had disconnected her own hose so that he alone was connected to her suit's bottle. Her thin lips were already touched with the cyanotic blue of suffocation.

In desperation, ignoring the signs that his own supply had finally run out, he twisted her helmet off to allow the now-filled lock's air to reach her and smashed her chest in a desperate attempt to restart her breathing.

He passed out just as the medics arrived.

Surra watched Taylor walk toward her across the Marsport concourse. How would it feel to be that young again; to have your whole life ahead of you, free and unencumbered by family and a stupid jinx? She'd probably never know.

Taylor flopped down beside her in that loose-jointed way of his, stuck his hands in the side pockets of his suit and slouched. "Been a real bitch, tracking you down," he said.

"Listen, Taylor," she said. "I'm real sorry my jinx ruined your race. I guess I should have warned you about it before we started; that would have been more honest."

"Honest?" he shot back. "What the devil is more honest than sacrificing yourself for me? It was my stupidity that sent us off the starting line half a second too early, not yours! That stupid jinx had nothing to do with it!"

"Just the same," she answered, "I'm sorry about what happened, but, you'll get over it. You're young. Huh, at least you'll be able to tell your grandfather that you broke the freaking record, even if we didn't win the purse."

"That doesn't matter; I don't need the money anyway! What I really

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want to know is why you pulled such a stupid stunt."

"Short odds, kid. I'd only be out a few minutes at most if you made it. If you didn't the rescue team was right there. Either way I'd come out a winner." She hesitated, "And so would you," she added softly.

"Damned asinine idea," Taylor repeated, but his smile took the sting out of his words.

Surra put her hand on his arm. "Listen, my shuttle is leaving real soon so say good-bye. Been nice knowing you, kid."

"Why did you sign a contract for wild-cat prospecting down in Maternis? Why didn't you ask me for a stake—you know I would have gotten it for you."

She held up three fingers. "First, Sid is an old friend; it's a good contract, so I won't get hurt. Second," she put down one finger, "I don't take charity, even from guys I like." Before he could react to that she touched the remaining finger. "Finally, I need to get the hell away from here, from the jinx reputation, from a lot of history that I'd rather you didn't know about, and a family that I'm not particularly proud to have."

"I know, I saw that you signed my bank draft over to your sister. That was your money, not hers."

"Told her that was the last time, and you know what? I feel free for the first time in years. Maybe getting a new start in Maternis will be for the best, much as I hate leaving all this behind." She waved her arm and laughed.

Taylor didn't blink. "There's some real work to be done on Io, you know. Gramps wants me to stake out some claims for him. Thinks it has great potential. I need a good prospector, somebody who has the guts and brains to explore some really risky landscape."

"Good luck," Surra replied. "Io's far enough away. I think it's probably out of the range of my jinx."

"I doubt that," Taylor responded with another of his boyish smiles.

"Yeah, you're probably right," Surra said. "My bad luck will probably stick with you the rest of your life, like the crap that sticks to the bottom of your shoe. Sorry," she added quietly.

The wall screen lit up with the number of her flight. She stood up and reached for her pack. It was a pitifully small package. Taylor put his foot on top of it. "I really need to go," she protested.

"No," he replied. "I need you on Io, with me, to make this prospecting venture work. Wouldn't be right to let you run away to the bottom of some deep Martian canyon because of some ridiculous reputation."

"So instead you want me to come out to Io, in the middle of all that radiation, the volcanoes, the ice, and especially the poisonous atmosphere?" she asked incredulously. "Yeah, right. Sounds like a great alternative. Now move your damn foot; I've got a contract to fulfill."

Taylor smiled, reached into his pocket, and pulled out a folded sheet. "Here's your contract. Paid Sid a good price for it, too. Man's a natural-born pirate. Matter of fact, I think I'll tell my grandfather to contact him. They'd get along great. Two of a kind."

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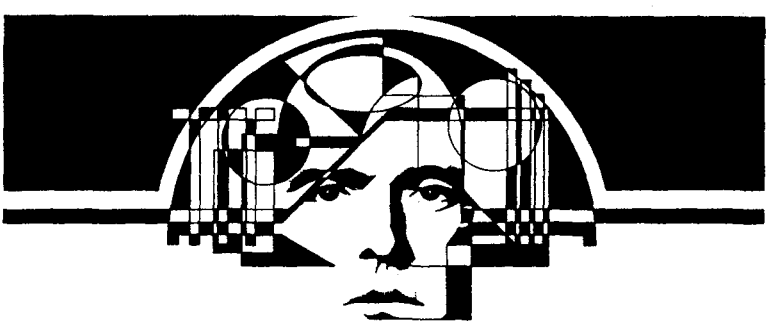
"Why did you do that?" Surra asked as she sank into her seat. "I know you don't have any interest in Martian mining."

"No, but I do have an interest in you, Surra. Hell, you just helped me defeat the biggest, baddest mountain in the Solar System! You've shown me what a damned adolescent I was being about my family. You made me understand myself, so how the devil can I let you go? Please, come with me. I don't want to come back here some day and find your cairn in the desert." He held out his hand. "I need you to remind me of what I was, and what I can be."

Surra hesitated. "Why do you have to be so damned young, so idealistic? Don't you know that people don't change? What the devil did you think you're doing; screwing up my life like this? Don't you know that I'm too freaking old for another damn mountain?"

"Come on, our ship's waiting," Taylor said, holding out two tickets. He picked up her pack and began to walk toward the orbital shuttle. "Nobody's too old. There's always another mountain, always another chance."

"Yeah," she replied as she fell into step beside him, following his lead, taking his hand in hers, "and I guess you just have to take them as they come."■



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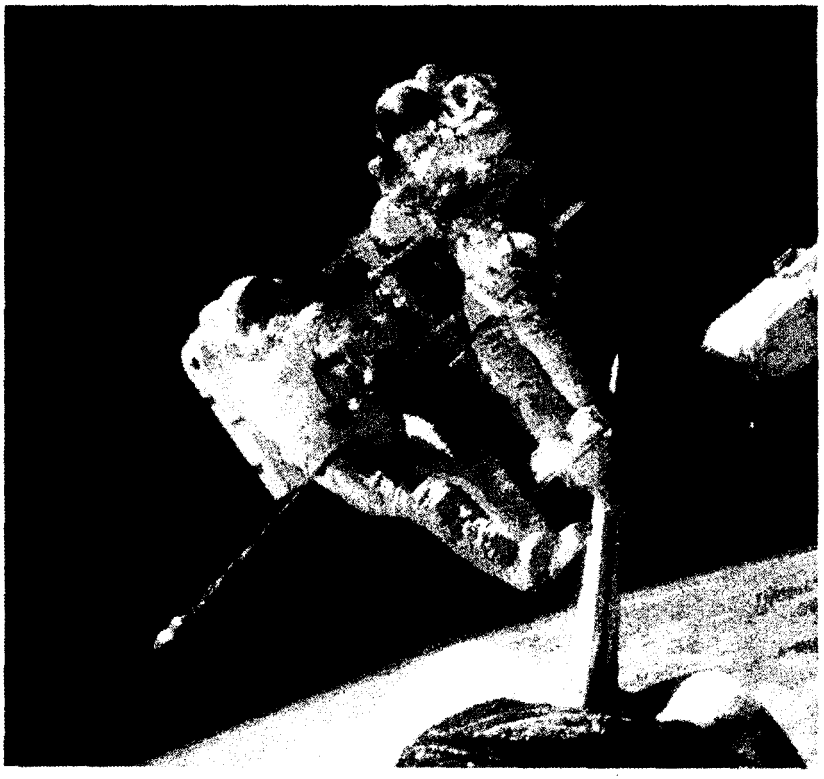
H. G. Stratmann

SEX IN SPACE: THE FANTASY AND THE REALITY



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Ever since she arrived at the space station yesterday on the shuttle, Elmer couldn't get Yvette out of his mind. She was a French biologist, sent by the ESA to study sex hormone secretion and mating behavior in the station's menagerie of mice and monkeys.

But Elmer fantasized about being her lab partner in a more personal form of that research. The normal shift of 1.5 L of fluid to her upper body after entry into microgravity made her voluptuous young chest more taut under her jumpsuit, those sensuous inviting lips fuller, and gave her voice a strangely alluring nasal quality. When his hand accidentally brushed against Yvette's as he showed her how to work the zero g toilet, despite the deconditioning of his sympathetic nervous system after months on the station, his heart beat so fast and loud she must surely have heard it.

Later, lying restrained in his private sleeping cubicle, Elmer lamented the fate that had brought him to this lonely outpost in space. He, like the other five men on the station, had been without female companionship for months. Even if Yvette too became lonely as the weeks passed, there was no reason to think she'd choose him *to "comfort" her instead of one of the others. Like him, those men must feel lust in space, also.*

And then he saw her. Yvette was floating toward him, an angelic vision of curvaceous loveliness, her long blonde hair streaming like a comet's tail behind her. "Ze life-support system, she keeps ze temperature so cold here. Could you make me warm?" Her hand tantalizingly unzipped the front of her jumpsuit, gradually revealing a mushrooming pair of ample—

This concludes the "fantasy" section of this article. The "reality" part that follows is roughly as erotic as a medical textbook. But I'm sure the serious, high-minded individuals who read *Analog* are more interested in the scientific rather than prurient aspects of this topic anyway.

During my exhaustive and painstaking research on the topic of human sexual activity in space, I was frustrated to find few references on the subject in the available literature. Men and women have been flying together in space since Vostok-6 in 1963. One would thus expect there'd be some documented, official confirmation that fornication in the final frontier had occurred. Or that NASA would have already implemented programs and procedures (the "ins and outs," if you will) for conducting research in this area. Many taxpayers would surely be interested in reading an official government publication describing in graphic detail the results of such studies. A video of the experiments themselves might prove even more popular.

This article summarizes what little is currently known about human sexuality in space. Because of the meager literature on this topic, one is mainly left with making educated guesses based on known physiological responses to the space environment and other established principles. While human sexual activity also involves serious psy-

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chosocial and ethical issues, these factors are beyond the scope of this article. Instead it will concentrate primarily on its biological aspects.

Not Tonight, Dear, I Have Space Adaptation Syndrome

As a mind experiment, let's consider the case of two human adults—one male, the other female. They're alone in a secluded portion of an orbiting space station and have decided to engage in consensual sexual intercourse. What kind of biological factors might hinder them from successful completion of this mission?

First, let's review the basic biological requirements for successfully performing coitus. In women, psychic (thinking erotic thoughts) and local stimulation of the genitalia activate cerebral and peripheral nerve pathways (primarily the pudendal nerve and sacral plexus) leading to and from the spinal cord. Parasympathetic nerves play especially important roles in this process. They dilate the arteries of erectile tissues (e.g. the clitoris) and stimulate secretion of mucus into the introitus. This produces a massaging rather than irritating effect on the penis during intercourse, facilitating both male and female climax. The latter is dependent in both men and women on spinal cord reflexes involving the sympathetic nervous system.

The ability of the male to complete coitus is clearly centered on achieving and maintaining penile erection. The latter results from a complex interplay between the penis's vascular and nervous systems. Psychic and physical stimulation cause parasympathetic impulses to pass from the sacral spinal cord through the pelvic nerves to the penis. These cause relaxation of penile arteries and the smooth muscle in its erectile tissue. The latter consists of large cavernous sinusoids that normally are nearly empty of blood. These sinusoids dilate tremendously when arterial blood flows into them under pressure and venous outflow is partially occluded. Since the erectile tissue is surrounded by strong fibrous tissue, the net result is hardening and elongation of the penis.

The effects of being in space and, specifically, microgravity on these responses is uncertain. Some individuals might find the thought of "doing it" in space psychologically stimulating, thus activating and intensifying these reflexes. Others may be inhibited by lack of privacy, overexcitement, anxiety, or other stressors associated with being in space.

Physical effects of microgravity may also have a dampening effect on this activity. Space Adaptation Syndrome (SAS) occurs in about two-thirds of astronauts shortly after arrival in space, and usually persists for days. It may result from fluid shifts from the lower to upper body, anxiety, neurovestibular (relating to the body's sense of balance and orientation) and ocular disturbances, etc.. Headache, dizziness, nasal congestion, nausea, vomiting, and other discomforts associated with it may reduce desire and ability to engage in sexual activity.

Hormonal factors could also have an impact. Testosterone levels were found to fall to < 20% of control values in male rats flown on COSMOS 2044

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for 14 days. Although the effects of prolonged microgravity on testosterone levels in human males are not established, a similar fall might have an observable effect on sexual desire and/or performance. The relative anemia and hypovolemia that occur in microgravity might also have mild adverse effects on penile function.

As described earlier, successful coitus involves stimulation of both parasympathetic and sympathetic nerves. Exposure to microgravity has relatively little effect on parasympathetic activity, and may actually increase it. Conversely, sympathetic activity may be reduced, with decrease in vascular tone. How much these responses may affect erection or climax is unclear.

The mild muscle atrophy and deconditioning that occur in space despite exercise programs can increase oxygen consumption and amount of work performed during sexual activity, especially by the more active partner. On Earth, coitus produces moderate and gradual increases in heart rate and blood pressure, with peak levels occurring at climax—usually in the range of 130 beats/minute and 150 to 180 mm Hg systolic blood pressure. Energy requirement averages 3.5 METs[1] during foreplay, and up to 5.5 METs during orgasm. This represents a modest level of work—roughly equivalent to climbing two flights of stairs.

However, these hemodynamic responses and peak workload can increase significantly when sexual activity is performed with an unfamiliar partner in a new environment. Coitus carries a slightly increased risk of myocardial infarction and sudden death (primarily in males) due to this increased workload. Since astronauts are physically fit and screened for coronary artery disease and other risk factors prior to flight, however, these dangers seem minimal.

Sex and Newton's Third Law of Motion

Assuming the biological prerequisites are met, microgravity itself may also represent a challenge for performing coitus. While some might find the idea of a coupling man and woman floating free inside a spaceship an interesting fantasy, in reality it could prove difficult and dangerous due to Newton's third law of motion. Both partners would have to carefully coordinate their movements and keep themselves secured to each other to reduce the chances of one or both rocketing into the side of their spacecraft during their most vigorous actions. Hitting one's head, or other sensitive area unexpectedly, while attention is focused entirely on sexual activity could not only break the mood of the moment, but cause injuries hard to explain to other crewmates or Mission Control. A misguided movement might cause lateral or backward buckling and fracture of the erect penis, which is just as painful as it sounds and requires surgery to repair.

A less adventuresome but safer approach would be to ensure both partners are "secured" and confined to a relatively small area. One method would be a fixed, cagelike structure

[1]MET = metabolic unit = oxygen consumption of 3.5 ml O_2/minute/kg of body weight.

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with padded sides and an interior volume only slightly greater than the two partners. Alternatively, one partner could be well-secured (e.g. with straps or other restraining devices) on a bed while the other is more loosely restrained. The latter, in a "superior" position, could grip appropriately placed handles or other fixed objects above or below them to prevent unwanted motion away from their partner. Side-to-side positions may require less extensive restraining systems.

A previous article in *Analog* (April, 1990) suggested that human coitus has not only occurred in orbit, but described a method of facilitating it. The problems dolphins face mating in water are similar to those encountered by humans in microgravity. A third dolphin assists mating by giving a well-timed push or restraining the backwards motion of one of its colleagues while the other two engage in intercourse. This technique is also reported to work with humans in microgravity, giving new meaning to the phrase "lending a helping hand." Those said to have successfully performed sex in space are thus said to be members of the "Three Dolphin Club." However, without proper documentation (e.g. the video previously described), how much of this is braggadocio and how much reality is uncertain.

In short, while the psychogenic, physiological, and physical effects of the space environment could impede performance of intercourse, there is no theoretical reason why, with proper planning and care, it cannot be performed successfully by humans. A small group of rats on Cosmos 1129 were, in fact, able to copulate in microgravity. Suitably motivated human beings should be able to do so, too.

How *subjectively* satisfying coitus might be in space compared to a more mundane terrestrial setting is difficult to predict. The idea that the sensations would *automatically* be somehow more intense or pleasurable seems, however, to be more fantasy than real based on what's known of the physiological effects of microgravity on the human body. A definitive answer to this question can't yet be given.

When (Or If) Ovum Meets Spermatozoon

On Earth, coitus between a fertile man and an ovulating woman can (obviously) cause pregnancy. Whether this can occur in space hasn't been established.

In microgravity, ejaculated spermatozoa should "stay put" within the vagina and be readily available for movement into the uterus and fallopian tubes. Transport of spermatozoa in the latter is accomplished by muscle contractions, ciliary action, and their own motility. These should be little affected by microgravity.

During the aforementioned experiment on Cosmos 1129, both ovulation and fertilization occurred in female rats. The embryos produced apparently underwent early development. However, they were then absorbed long before term and lost. The reason for this failure to survive to birth is not known. Male rats on that 18.5-day flight were also mated with nonflight females five days after landing. The latter had larger litters than

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controls, but offspring had a higher rate of developmental abnormalities, including growth retardation. The implications of these findings in humans, particularly on bringing an embryo/fetus to term, are uncertain.

If pregnancy isn't a desired goal following coitus in space, contraception must be considered. Surgical sterilization is an option for astronauts who don't wish to have children in the future. Birth control pills containing estrogen and progesterone alone or in combination are highly effective if used properly on Earth, but effectiveness in microgravity hasn't been established. Lack of gravity has been shown to have significant effects on absorption, duration of action, and peak blood levels of other drugs, and could affect the timing of administration and dose of birth control pills needed for efficacy. Extended-release medroxyprogesterone acetate (Depo-Provera) or levonorgestrel implants (Norplant) might be a more dependable choice. Barrier devices (condoms and diaphragms) with or without spermicidal agents would probably retain similar efficacy in space as they do on Earth.

Coitus interruptus and the "rhythm" method are marginally effective contraception techniques at best, and performance in microgravity would be even more problematic. The former, if done successfully, could result in globules of semen floating within the spacecraft. If not quickly confined and disposed of, these would not only be aesthetically displeasing but might represent a health hazard if aspirated by other members of the crew. Astronauts are currently screened preflight for hepatitis B and sexually transmitted diseases, however, so the risk of a crewmate becoming infected by inhaling "second-hand semen" appears small. Increased menstrual cycle unpredictability in space (see below) would make the rhythm method particularly impractical for preventing pregnancy.

The space environment itself may have significant contraceptive effects. There apparently have been no formal studies yet on the effects of microgravity on menstruation in human females. Because it produces many physiological effects similar to microgravity, prolonged bed rest has been used to indirectly assess the impact of the space environment on menstrual function and related physiological effects. Both prolonged bed rest and entry into microgravity normally shift 1.5-2.0 L of fluid from the lower to the upper body. This initially causes mild edema (swelling) of the torso and face, then triggers a diuresis of what the body considers "excess" fluid. Bed rest studies have shown that initiating such rest in the immediate preovulatory stage of a woman's menstrual cycle produces an increase or only a small decrease in plasma volume for the first four days. Thus, by analogy, a female astronaut's entry into space at that time in her cycle might also result in delay of this expected diuresis.

Other bed rest studies have shown no significant change in menstrual cycle length. Eventually studies of these and other effects on menstruation and ovulation (including serial measurement of serum gonadotropins, progesterone, and estrogen levels) will need to be conducted in microgravity itself over at least one complete men-

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strual cycle (about 30 days). While not possible with short-duration (< 14 days) shuttle flights, a prolonged stay on Mir or the international Space Station would make this practical.

Menstrual dysfunction is likely to occur in female astronauts from several factors. Alterations in normal circadian rhythms, the intensive exercise programs needed both pre-and during flight to perform mission objectives and reduce muscle atrophy, stress, and possibly direct effects of microgravity on the hypothalamic-pituitary-ovarian axis may result in lack of ovulation and even menorrhagia (excessive bleeding). Microgravity may also induce retrograde menstruation (regurgitation of uterine blood and tissue backwards through the fallopian tubes and onto pelvic and abdominal organs, e.g. the ovaries) and endometriosis (the type of tissue lining the uterus is present in an abnormal location, usually within the pelvis), potentially causing long-term infertility after leaving space.

Effects of microgravity on male fertility are also not well-established. Endocrine disturbances (e.g. the fall in serum testosterone in rats described previously) and changes in sperm motility may decrease fertility. Toxins used in life-support systems, propellants, etc. in spacecraft may reduce sperm counts. Conversely, microgravity-induced fluid shifts may decrease varicoceles (abnormally dilated veins of the spermatic cord), resulting in increased sperm counts.

Exposure to radiation in space can also impair fertility or, in women, lead to premature ovarian failure. An individual at sea level, protected by the Earth's atmosphere and Van Allen belts, receives an annual radiation dose of 100-200 mrad.[2] Conversely, cosmonauts on Mir for over a year received nearly a hundred times this dose (up to 8.7 rad). The Sun produces both electromagnetic and particulate radiation. The latter could produce acute exposures of hundreds of rads to an unprotected astronaut during solar flares. Cosmic rays are also a constant source of radiation.

Spermatozoa-forming cells and spermatozoa themselves are among the most radiosensitive cells in men. Acute doses of as little as 10 rad, or cumulative exposure to lower doses (e.g. during prolonged stays in space) can impair male fertility for years. Fatal radiation doses are required, however, to produce azospermia (destruction of all spermatozoa). Mature spermatozoa are most sensitive to potential genetic damage which could produce defects in offspring. However, based on studies in men exposed to atomic bombs used on Japan, this risk appears to be small. The risk could be further reduced if a man exposed acutely to high-dose radiation refrains from trying to cause pregnancy until after the normal 74-day period for a full cycle of spermatogenesis. Interestingly, libido doesn't seem to be affected by even high radiation doses of up to 600 rad.

In women, the 5-7 cm intraabdominal depth of ovaries attenuates the radiation dosage they receive. Testes

[2]rad = radiation absorbed dose. One rad = 100 ergs of absorbed energy in 1 gram of material.

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have no such natural protection, although appropriate scrotal shields could be worn. Oocytes (immature eggs) are also more resistant to radiation-induced genetic defects since, unlike spermatozoa-producing cells, they aren't actively dividing and have good enzymatic repair systems.

Conversely, while males have the capacity to repair gonadal damage and create new spermatozoa, eventually recovering normal counts, females only have a limited supply of oocytes—if destroyed, they can't be replaced. A single dose of 300-400 rad usually results in complete elimination of oocytes and estrogen production from ovaries. In those exposed to smaller, repeated doses, effects on fertility are cumulative. Radiation can also cause endometriosis, impairing fertility long after exposure.

In astronauts wishing to have children after prolonged stays in space, spermatozoa, oocytes, or fertilized embryos can be cryopreserved beforehand. These would then be available for inducing pregnancy via standard in vitro implantation techniques. Cloning may also become an option in the near future.

Macrogravidity in Microgravity

NASA's current Medical Standards (JSC 11570) specifically disqualify any pregnant woman from going into space. Microgravity, radiation, and other hazards represent a significant risk both to the woman and her embryo/fetus.

Pregnancy induced sickness (PIS, "morning sickness") is common early in pregnancy, usually abating about the 16th week of gestation. SAS can produce many similar effects, especially nausea and vomiting. The combination of these two problems would, at best, be expected to accentuate and perhaps increase duration of PIS. At worst, it could produce hyperemesis gravidarum, with prolonged severe vomiting and the potential for severe dehydration and liver damage.

During pregnancy in one *g*, heart rate and blood volume increase. Fluid retention usually is greater than the increase in red blood cell production, resulting in a relative anemia. Microgravity itself results in cardiovascular deconditioning (loss of vascular tone), the previously mentioned loss of 1.5-2.0 L of fluid, and an approximately 15% reduction in red blood cells during the first 60 days in weightlessness. The combination of these "normal" changes with those produced by microgravity could seriously impair blood flow and oxygen delivery to the fetus, particularly if the woman were to return to one *g* later during pregnancy. At best, fetal growth might be impaired, with low birth weight. At worst, it could cause neurological impairment or death.

Microgravity-induced fluid shifts would decrease the incidence of varicose veins and peripheral edema (leg swelling) often seen in the later stages of pregnancy. Problems with back pain and difficulty moving in the latter stages of pregnancy would also be reduced. Conversely, pregnancy-related complications that are relatively minor on Earth, like urinary tract infections and gestational diabetes, would be more difficult to deal with in space due

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to limited supply of medications. Also, during pregnancy basal metabolic rate increases with concomitant elevations in oxygen consumption and generation of body heat, thus putting greater demands on life-support systems.

Even with vigorous exercise programs, astronauts lose 15-20% of preflight muscle and bone masses during prolonged exposure to microgravity. In pregnant women, microgravity-induced loss of mass and strength in pelvic musculature necessary for delivery and demineralization of bones present special problems. Fetal bone growth requires that a pregnant woman receive supplemental calcium, otherwise it will be obtained from her own skeleton. This "normal" tendency toward osteoporosis would be exacerbated by the calcium loss from bone caused by microgravity.

Besides its adverse effects on the woman (acute injury or increased long-term risk of cancer), radiation might have significant teratogenic effects on the embryo/fetus. High acute doses within the first 2 weeks of gestation are far more likely to result in spontaneous abortion than birth defects. Although it can have serious effects at any stage, radiation is most likely to impair fetal development between 8 and 25 weeks of gestation. Cataracts, abnormal genitalia, microphthalmia (small eyes), decreased life span, microcephaly (small head), and mental retardation may result. Although controversial, there may also be a mildly increased risk of childhood leukemia.

The threshold radiation level below which fetal risk is minimal has not been well-established, but 5 rad has been suggested. Suggested maximum cumulative radiation exposure to the fetus for all nine months of pregnancy in terrestrial female radiation workers is 0.5 rem.[3] The total radiation dose (10 rad or more) a pregnant woman could receive during long-duration orbital or deep space missions without adequate shielding would represent a significant risk to fetal development. From studies of children exposed in utero to the atomic bombs at Hiroshima and Nagasaki, the highest risk of mental retardation from radiation is at 8 to 15 weeks gestation, with even small doses of radiation increasing risk. Incidence of severe mental retardation ranges from 4% for 10 rad exposure to 60% for 150 rad. Even in children who aren't retarded, there is a radiation dose-dependent reduction in IQ, particularly with exposure between 8 and 15 weeks gestation. These effects appears minimal past 25 weeks gestation.

Toxins within spacecraft represent significant health risks for both the woman and fetus. Inhalation of excessive levels of chemicals like carbon monoxide, nitrogen tetroxide, or hydrazine could produce respiratory distress and anoxia. The developing fetus is particularly sensitive to anoxic encephalopathy from these or other causes.

Decompression sickness could result from sudden loss of cabin pressure in spacecraft. Nitrogen comes

[3]rem = radiation equivalent man. It quantitates long-term radiation effects in human tissue. One rem = rad x Q (quality factor). Q=1 for X-rays, gamma rays, and most electrons and protons; 10 for neutrons; and 20 for alpha particles.

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out of solution as bubbles in blood and other body fluids, resulting in difficulty breathing, weakness, paralysis, pains in the limbs, and convulsions. Women, with an average of 11% more adipose tissue than men, are theoretically at four times greater risk of developing this problem. The fetus is particularly vulnerable to the effects of nitrogen bubbles. Those which form in the venous system will rapidly embolize to the arterial system by passing through the foramen ovale (an opening between the heart's upper two chambers, or atria) and ductus arteriosus (a blood vessel connecting the pulmonary artery and aorta), impairing blood supply to critical organs like the brain.

Studies involving pregnant women who developed decompression sickness during scuba diving demonstrated an increased incidence of fetal cardiac arrhythmias and congenital malformations. Treatment of decompression sickness primarily involves use of hyperbaric oxygen, which is teratogenic in the first trimester.

Lack of state-of-the art medical facilities in space would also impede care of women with higher-risk pregnancies and deliveries. The full spectrum of complications which can threaten the life and health of both woman and fetus on Earth could also occur in space, with disastrous results.

Preeclampsia usually occurs in the second and third trimesters. It manifests as hypertension, proteinuria, headache, and visual disturbances. Though not life-threatening in itself, it can worsen into eclampsia, with potentially fatal seizures and coma.

Hemorrhagic problems due to partial separation of the placenta from the uterine wall (abruptio placentae) or other causes would be of major concern, especially in view of limited blood supplies in space and the relative anemia and hypovolemia caused by microgravity. Incidence of ectopic pregnancy (implantation outside the uterus, in a fallopian tube or elsewhere in the abdomen) may be increased by microgravity and, if not identified early enough, can become a surgical emergency. Preterm labor, while not necessarily dangerous to the woman, could result in fetal loss. The effects of microgravity or acceleration/deceleration (e.g. during launch or reentry) on premature or term rupture of the amniotic sac are not known.

Delivering a baby in microgravity could be challenging unless the woman herself, medical personnel, and instruments were secured. Fetal monitoring equipment would be essential. Maintaining sterility and controlling the normal release of blood and other bodily fluids (e.g. amniotic fluid) at birth in microgravity would also be difficult. A modified "birthing chair," perhaps with an airflow system similar to the Shuttle's "zero *g*" toilet to trap fluids, might be used. Anesthesia using intravenous or local (e.g. for regional blocks) agents could be provided. Standard epidural and spinal anesthetics are at least partially dependent on gravity for their effectiveness, and their value in reduced gravity is uncertain.

These difficulties would be compounded if a cesarean section became necessary. This would require not

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only an expert assessment that the procedure was needed, but also an individual trained to perform it. Issues regarding maintaining a sterile field for the operation would be even more pressing in that situation.

First Comes Love, Then Comes Marriage . . .

The final topic relating to human sexuality in space is its ultimate result—children. The same hazards (especially microgravity and radiation) that threaten the health of adults carry greater risk to babies, young children, and adolescents. Unlike adults, the bones and muscles of children are still developing. Long-term exposure to micro- or low gravity could result in growth retardation due to lack of the stimulating effect of one *g* on increasing muscle mass and both mineralization and growth of bones, particularly the long bones of the thighs and legs. Potential effects on the skeletal system could include delayed closure of the fontanels of a baby's skull, short stature due to decreased lengthening of long bones and premature closure of epiphyseal (growth) plates, and abnormal development of vertebrae, possibly leading to nerve compression syndromes.

Experiments with young, growing rodents in microgravity have yielded differing results. While all demonstrated the expected demineralization, effects on longitudinal and radial growth of bone varied, with some studies showing no effect and others a decrease.

Total muscle and bone masses of physically fit adult astronauts fall to 80-85% of preflight values during long stays in microgravity despite exercise programs (e.g. walking several hours per day tethered to a treadmill), which attempt to limit this loss. However, neither infants nor very small children have the physical ability to cooperate with such intensive exercise regimens. The muscle and bone masses they stabilize at may thus be considerably lower than 80% of normal for their age.

Infants raised in microgravity wouldn't learn how to walk or develop "normal" neurovestibular reflexes. They would probably have great difficulty adapting should they later be abruptly brought to the one *g* of Earth. Gradual adaptation and learning while still in space using an artificial gravity system generating < one *g* should ameliorate this problem. The question of how prolonged exposure to micro- or low gravity would affect overall neurological (particularly brain) development of children is unanswered at this time.

An intrinsic hazard of having children in space is their emotional and mental immaturity relative to adults. As any parent who's tried to "childproof" their home knows, due to their natural curiosity children are adroit at finding creative and unexpected ways of hurting themselves. While risk of injuring themselves in falls would be less in reduced gravity, there'll be plenty of electrical, toxic and other physical dangers inside a spacecraft or a habitat on the Moon or Mars to endanger the child itself or others. Early education and training of small children would be essential. Without stringent precau-

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tions, "Daddy, what does this button do?" might be followed immediately by firing of spacecraft rockets, or exposure to the vacuum of space. Even with training, however, a child's obedience to even the most important rules is unpredictable.

Other potentially serious physiological effects of reduced gravity include cardiovascular deconditioning and endocrine disturbances. The former isn't significant in microgravity, but could make adaptation to one *g* more difficult in children than in adults. The effects of micro- or reduced gravity on the hormonal changes which induce puberty aren't known either, and could impair its development.

Radiation in space can have serious immediate and long-term health effects in both adults and children. Whole-body doses of 50-150 rad received quickly (e.g. an astronaut conducting extravehicular activity during a solar flare) cause vomiting and diarrhea within hours. On Earth these are rarely fatal, but would be more serious in someone confined to a space suit. Higher doses (150-400 rad) cause these same symptoms and also destroy bone marrow cells which produce platelets (needed for blood clotting) and red and white blood cells. Bleeding, anemia, and life-threatening infections develop about three weeks later. Even with aggressive measures like bone marrow transplantation, exposure to 350-400 rad is fatal in 50% of cases.

An acute dose of > 400 rad critically damages cells lining the intestines. This causes profound diarrhea and dehydration (due to inability to retain or absorb food or fluids) starting 4-6 days post-exposure and septic shock (overwhelming infection caused by normally benign bacteria passing through the damaged intestines into the bloodstream). Despite treatment with intravenous fluids and antibiotics, mortality from 400-800 rad is 50-90%, and virtually 100% at higher doses.

Acute radiation doses which might injure but not kill an adult could be lethal in a child. This reflects the smaller size of a child relative to an adult, with less overlying body tissue to attenuate penetration of radiation to critical organs (e.g. bone marrow and intestines), and greater susceptibility to radiation-induced dehydration and infections.

Gradual exposure to typical radiation levels in space too low to produce acute effects can still cause cataracts and (by damaging DNA in the body's cells) cancer years later. The probability of dying from cancer increases as the total, cumulative amount of radiation a person receives in their lifetime increases, even when *individual* radiation doses or *rate* of exposure are quite low. Also, for a given level of lifetime radiation exposure, younger people are more likely to eventually develop cancer than older ones because their life expectancy is greater, and hence there's more time for cancer to eventually occur.

NASA guidelines limit radiation exposure to internal organs of astronauts in low-Earth orbit to 25 rem over 30 days, and 50 rem in a year. Limits for *total* radiation exposure during an adult astronaut's career are based on an estimated 3% increase in lifetime risk of dying from cancer rela-

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tive to comparable individuals who don't go into space. At age 55, the limit is 400 rem for men and 300 rem for women. Conversely, at age 25 the limits are 150 rem for men and 100 rem for women. (The limits are lower for females mainly due to increased gender-specific risks like breast cancer and permanent infertility.) With their even longer life expectancy, the cumulative radiation exposure needed to reach the 3% "excess cancer mortality" level would be even lower in children, with increased risk of malignancy during childhood (e.g. acute lymphocytic leukemia) or in adult life (e.g. breast and thyroid cancer).

Finally, susceptibility of children raised in space to infections is also of concern. Immune system function, especially killer T-lymphocytes, is reduced in microgravity, potentially increasing susceptibility to viral and other pathogens. Due to intensive prescreening and the relatively small number of individuals who'll live in space in the near future, a child would be exposed to a limited range of infectious organisms. However, the immature immune system of children may be more vulnerable to those which are present in life-support systems—and especially other people. Also, bacteria in space may become more resistant to antibiotics, complicating treatment of infections.

Conclusions

As more people travel and live in space, it's inevitable they'll do all the activities they do on Earth—including sex. While more difficult and perhaps dangerous to perform in micro- or reduced gravity, coitus can and will occur in space (and perhaps already has). In the future new researchers, following in the footsteps of terrestrial pioneers in sexology like Masters and Johnson, will conduct scientific studies regarding the effects of the space environment on human sexuality. One might assume they'll have little difficulty recruiting volunteers for the most obvious of these experiments.

Problems involving human fertility, pregnancy, and child-rearing in space are daunting, and will need to be addressed as permanent colonization of space becomes a reality. The adverse effects of reduced gravity and radiation are the most serious. Artificial gravity induced by rotating a space station, L5 colony, or tethered spacecraft system would ameliorate many of these effects, as would the .38 *g* of Mars. Careful shielding of spacecraft and use of indigenous materials and underground habitats on planetary colonies should reduce acute and chronic radiation exposure to manageable levels.

Even problems with ensuring normal growth in children raised in space and successfully adapting to one *g* if they come to Earth, while challenging, should not be insurmountable. A combination of medications to stimulate bone growth, diet, gradual adaptation in artificial gravity and (in older children) intensive exercise should be sufficient. There's no theoretical reason why, in the more distant future, genetic engineering to better adapt the young to space (e.g. increasing radiation resistance, inducing normal bone and muscle growth without the stimu-

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lus of one *g*, etc.) cannot be done.

A permanent human presence in space presents not only formidable technological but biological challenges. The issues discussed here involving human sexuality present their own unique problems and difficulties. But if colonization of space is ever to occur, they will need to be addressed—and solved.

Postscript

It's come to my attention that, of all the thousands of sober, scientifically-inclined individuals reading this article, one of you has a more salacious interest in its subject matter. As a service to that reader (you know who you are), let's return to its "fantasy" section. We rejoin our characters with the story already in progress. . . .

Yvette hastily redonned her jumpsuit, her edematous face failing to conceal anger and disappointment. "Perhaps we'll try again when you feel more, how you say—up to it?"

Alone again, Elmer watched that recalcitrant part of his anatomy floating weightless—still limply mocking his feverish attempts at mind-over-matter. Despite her words, he knew there'd be no second chance.

A few days later the entire crew was gathered in the station's common living area for a group recreation period. Shuffling a deck of cards, Elmer said without thinking, "Anybody for a game of Stud Poker?"

The other five men winced, and looked down embarrassedly. Finally Yvette's bitter laughter broke the silence.

"It seems ze only game you boys can play is 'Old Maid'!"

Unfortunately, even in space, reality might not live up to fantasy. ■

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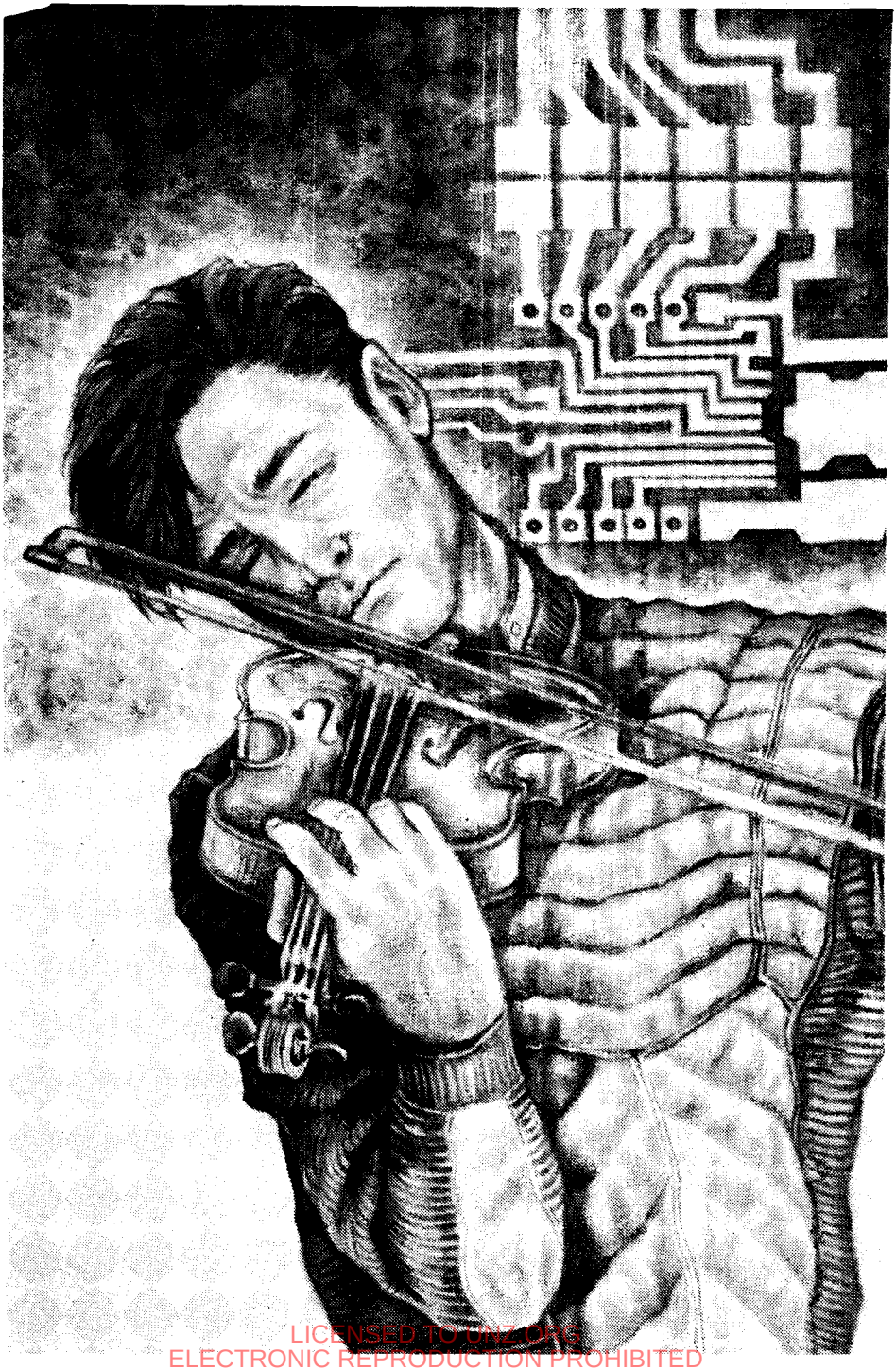

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Shane Tourtellotte

MORTAL INSTRUMENTS

Determined people will do almost anything to gain a competitive edge. But there's one thing they'd better remember. . . .

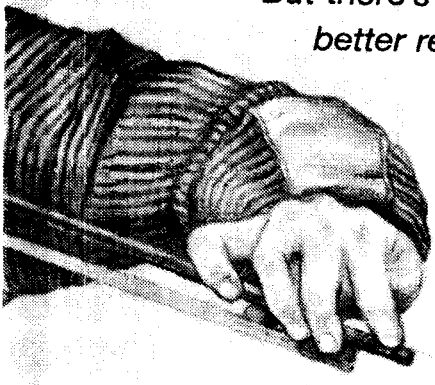

Illustration by Dell Harris

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Tadeusz Nikisch watched through the front window as his last pupil got into the car with her mother. "I said I would call you if my schedule opened," he remonstrated.

John Button jerked himself to his feet, nearly bumping his bow case off the coffee table. "I didn't have any more time. My audition with the New York Philharmonic's tomorrow afternoon. If I waited for you—"

"John, please. An hour or two more will make little difference." Tadeusz kept calm with his natural ease. John Button wasn't half his age, but already his forehead was as lined as his own. "You know the advice I've given you, and I accept that you haven't taken it."

"Why should I? You tell me to live with my limitations. Translated, that means give up."

Live within, Tadeusz recalled saying, but he left it. "It means nothing like that. Please, John, sit."

John resisted scornfully, only for a moment. Tadeusz sat by him, taking a second to nudge the cases away from the table edge.

"I've told you my evaluation before. You have a love of music, and there is no greater gift in the world. Your gift for playing is not as great. The violin is so dependent on a good ear for precise playing. Technical mastery can take you far, but only so far. With other instruments, it matters much less. I wish you would take up piano, as I have suggested."

"I don't want to play piano."

Plain and unassailable, as always.

"And so, I suggest taking smaller steps. The state orchestra is within your reach." John winced.

"This upsets you?"

"'Our state orchestra,'" John recited, "'is a natural repository for the broad ranks of mediocrity in today's string players.'"

Tadeusz couldn't deny his words: John probably had that magazine article framed somewhere. "Mediocrity is relative," he maintained. "A mediocre . . . er . . . Yankees player still has greater talent than most. Is it shameful to be among the lesser of the best?"

"Doctor Nikisch, please." John kept his eyes averted for a long moment. "I came for your help," he said softly. "I wanted one last edge, one refinement or insight that might make the difference tomorrow."

"One day out of a dozen years will mean this much?"

"Maybe. Would I have come this far without all that work? Can I expect to get any farther without more?"

Tadeusz looked aside. Music didn't exist to "get far," but perhaps his was a minority opinion. "I can't give you instruction tonight." He turned his eyes back, sharp and firm, before John could protest. "If you insist on a practice session, come early tomorrow, say six-thirty. I can give you two hours before my Saturday pupils."

John smiled, but the tension stayed. "Thank you. You know how much this means to me." He reached for his cases. "I need to brush up my *vibrato*. I can't play an auditorium any other way." The sad gaze struck him, and he held his violin protectively close. "Let's not argue that again. It's standard technique."

"Yes. So it is." Large, modern audiences demanded the fullest projec-

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tion from the players, whatever the cost to the subtleties of the music. "Some people insist that birds fly on steel-feathered wings."

John absorbed this without a flinch. "Thank you, Doctor Nikisch," he said at the door. "I wouldn't be where I am without you. I'll try not to let you down," he said in parting, oblivious to the irony.

The practice hall was thick with people and tune-up sounds when John arrived. He squeezed himself to his chair without a word, sat down, and took out his violin. He muttered "Sorry" as he jogged someone while opening his bow case.

"I said, how did your audition go?"

"Oh, Sara. Fine, it was fine," he said, even as his stomach began twisting anew. "How are you?"

"All right." Sara Weber leaned in closer. "Are you?"

"I said I was fine." He flushed. "Sorry, jitters. I'll be hearing if they'll call me back soon."

"Well, good luck." John's mouth twisted: too late. "I know how important this is to you."

The arrival of their conductor saved him from another hasty reply. The Caledon Symphony Orchestra began its summer concert season in a month, and rehearsals were up to thrice a week. He led them straight into the first suite of Prokofiev's *Romeo and Juliet* ballet.

The knots inside John pulled tighter from the first note. The CSO was a stepping-stone, the "to present" line on his résumé. He shared concertmaster status with Sara, something he couldn't resent personally the way he might professionally. His advances left him the conviction that he could go farther. Yet he hadn't.

His thoughts started to fade beneath the second language he was playing. The turmoil briefly colored, then submerged beneath, the music. Prokofiev now outvoiced Button, even as Button gave him that voice. It was the great consummation, the two artists silent without each other, together made briefly immortal.

The conductor stopped the music to instruct the basses, and the slender bond snapped. John was alone again with his thoughts, and when the music began anew, he could not slip away from them. The bliss was so rare, and always so transient when he found it, while others grasped the gift effortlessly.

John's ear for pitch was average, meaning poor for a violinist. The correct intonation natural to some was a struggle for him. That fault was the drag on his ambitions—and the shut door between him and the rapture he could but touch.

To know every note, recognize it for itself, not as a string or a key . . . and then have their structure and harmony course over you, an open book, a secret joyously given . . . the daydreams John had of such a passionate rapport thrilled him, crushed him. If he could work a little harder, rise a little higher, play with those who understood. . . .

The unbreakable cycle thwarted him. Professional success and the true knowledge of music: each needed the other, the way Prokofiev needed

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Button . . . or any other musician.

John worked the rest of the rehearsal with a hard-set frown, which most took for a sign of his dedication. It remained as he put away his violin and bow, only wavering when he saw Sara regarding it with something like condolence. He wiped it away, much too late.

"It wasn't good," she said, not even making it a question. "I'm sorry."

John squirmed, started to turn, but couldn't make himself leave. "My fault," he muttered. "Berg's Violin Concerto isn't my best piece."

Berg's requiem was a serial composition, without specific key. He chose it in a moment of cowardice, playing away from his weaknesses, but finding no strengths in the notoriously difficult cadenza he performed. The music didn't reach him in even the limited way that traditional pieces did . . . and it showed.

Sara walked past him, bringing him along with a touch on the shoulder. "I guess you keep practicing. Nothing comes easily in this work." His shoulder dropped away from her hand. "Did I say something wrong?"

"No, no."

Sara broke away momentarily to intercept the conductor, saying something about the next rehearsal and no guarantees. "What was that about?" he asked when she returned.

"I'm going to Philadelphia, for my sister. I told you this, didn't I?"

"I don't . . . wait. Is this an operation?"

"Yes, it's *the* operation. She's getting the implants tomorrow. I'll be there Wednesday morning, and cross your fingers, she'll finally get to hear me say 'hello.'"

"Really?" John knew Sara's sister was deaf, but she definitely had not told him of this operation. They were "friends," and maybe she assumed she'd tell a friend. "Uh, listen, I'm very sorry if I didn't remember your saying all this. Can I make it up to you, by driving you to Philly and back?"

"Don't you have work, John?"

"Nothing I can't reschedule." The few students he took were young, and would likely be glad to miss a session. "Please. I haven't even met your sister, and what better time?"

They stepped outside, into a cool night breeze. "Sure, it'd be fine if you came." She sounded less than gleeful. "I just don't want you getting the wrong idea, John."

"I'm not, Sara. Promise." He got a time for them to leave, and then they split. John sat for a long time behind the wheel of his car, asking himself what idea he did have.

The doctors kept them waiting long enough to finish a test series, then made a dramatic presentation of Sara's entrance. John watched from the door as Sara and Mara embraced. Mara's hug was slightly impeded by wires running from behind her ears to a softball-sized box strapped between her shoulders. Sara began speaking sign language, but Mara stopped her with a touch to the lips. She devoured Sara's spoken words with the unique enthusiasm attendant to a joy lost and regained.

Mara pointed his way and Sara waved him over. "Pleased to finally meet you," he said after Sara intro-

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duced him, and he offered his hand.

Her attention was momentarily disconcerting, eyes focusing on his lips. Mara still had to read his words to understand them, but she was already connecting them to the sounds, reteaching herself this language lost since early childhood. Sara signed something to her sister, something she didn't want John intercepting.

"Good to meet you, too." Mara grimaced with frustration, hearing her own blurry words beside their clear speech. "Sara's told me a lot about you."

"Oh, I'm sure she has."

One of the doctors began giving Sara a progress report. Mara was testing superbly, outscoring most unimpaired people on sensitivity and range. He began outlining the workings of the system, but Sara said she had heard it all before.

"Actually, this is pretty new to me."

The doctor gladly began explaining it on John's behalf. The box on Mara's back received the sounds, transmitting them to chip clusters implanted within each ear. Microcircuits measured intensity and pitch, passing the data to a stimulator that converted the signals to electrical impulses. The impulses went to an electrode array in her auditory cortex, bypassing the auditory nerves atrophied by long inactivity—and Mara heard.

John remained on the fringe of the sisters' happy moment until the doctor stepped outside. Telling Sara he was going to find a bathroom, he followed seconds later.

"Doctor . . . Hippert." John spied the name tag as the doctor turned. "Don't mean to bother you. I was wondering . . . you said the implants measure the pitches of sounds. That's pretty advanced."

"True. If we'd had the implant technology five years earlier, our first experimental patients would have been tone-deaf."

"So she has perfect pitch. Not all normal—er, reg—not everybody has that."

"No, I understand it's somewhat uncommon." Hippert shifted his feet. "Take a deep breath, and come to your point."

John wasn't sure what his point was, until he heard himself blurt it out. "Could you do that with normal-hearing people, who just don't have full pitch awareness?"

Hippert let his face go blank, then waved John into a side room. "If you're talking about a voluntary procedure, remember that this operation is still classified experimental."

"For how long?"

He let the question pass. "There's no reason for such a procedure, no everyday benefit that outweighs the cost or the risks."

"I'm not an everyday person," John declared. "I'm a musician. A violinist. Doesn't that suggest some benefits?"

Hippert's snap answer died unspoken. He pulled over a chair, and sat to think. John watched his face, and thought he saw the moment when it shifted from hazard to opportunity. "It isn't how the procedure was conceived."

"But it's possible. If it weren't, you would have said already."

Hippert smiled quietly. "It should

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be easier than full restoration. The circuits only have to measure pitch; the electrodes can hook into healthy ganglia. You wouldn't need the external equipment. The worst problem would be synching the artificial input to what you get naturally."

"Sounds like a worthy challenge."

The smile hardened. "First, Mister Button, this procedure may not be approved beyond experimental applications. Second, insurance companies may have to cover experimental surgery, and correction of profound impairments. They won't fund voluntary surgery, and you won't get anyone to think that average hearing is impaired."

"The money doesn't matter. I have it." His parents had provided well for him, or he could never have pursued the violin so fastidiously.

"You really do?" Hippert named a sum. Blood started pounding in John's ears, but he nodded. "You really should think this over carefully, but if you do, and you're still interested, I'll handle it."

He rose, but paused at the threshold. "You are right. It would be a challenge. Now, maybe you should get back to your friend."

John stood there a second before reacting, and then almost passed Mara's room before remembering why he was walking that way.

"Broad approval is coming, no more than two weeks from now." Hippert's call came a week later, just as John had begun dismissing the episode as a deluded fancy. "I need to conduct some scans and tests first. You can come in now if you like, so we can start immediately once they grant formal approval. I don't know whether you've thought it over. . . ."

"More than you know, Doctor." With the moment upon him, he still wasn't certain what he was about to say. "Friday morning's the best time for me."

"Fine. How about I expect you at nine? See you then."

John hung up, and began staring blankly around his living room. That lurking notion, that one brief moment of courage . . . curiosity? . . . the momentum had carried him to this bizarre pass. He wondered at his presumption, wondered what could have compelled him.

Then he remembered, and felt his heart find its rhythm again.

He went to pick up the violin, restart his practice. He almost put his instrument back down. Should he make himself listen to a shadow of the music, when the full form of it was so near at hand? Would it someday soon seem a pitiful use of his time, to clutch at this shadow?

The bow lowered to the strings without his will, ending his equivocation. Such a beautiful shadow. How much more rapturous the full body would be.

John made it back to Caledon with time to spare for his afternoon pupils. He took dinner alone as usual, spent a while honing his *vibrato*, then drove to the practice hall. He casually greeted the tympanist on the way in, and didn't notice the look.

The room sounded odd before John

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even entered, filled more with hushed voices than tuning instruments. Passing the threshold seemed to turn a switch, quieting the talk nearly to nothing. John intuitively kept his eyes low, but still the stares crowded in.

Once in his chair, John cleared his head. His anticipation was making him imagine things. Sure enough, the players were tuning up. He took a long breath, and started adjusting his own violin.

Sara arrived with a rustle. He turned to smile at her, but she was looking the other way. Before he could ask how her sister was faring, the conductor called for their attention, and they went straight into "The Montagues and Capulets."

The evening went swiftly, despite the occasional look John worked not to misinterpret again. The orchestra finally had a handle on Prokofiev's opus, and the next three weeks would smooth their rough edges. When the composer called it a night, John was still ready to play for hours.

He closed up his cases, and started after Sara. "Great night's work, I think."

Sara's head twitched but didn't turn. "Could you walk me to my car, John?"

John followed obediently, not comprehending her queer mood. Halfway across the parking lot, an unhappy idea presented itself. "Has something gone wrong with Mara? Is she all right?"

Sara wheeled. "You mean is the implant all right, don't you?"

"Wh—well, yes, of course."

Her hand snapped back a few inches. If she hadn't been carrying her bow case in it, John was certain she would have slapped him. "You couldn't care less about my sister, only the hardware in her skull! You fooled me pretty well, but it's the last time."

She stomped away, but John wasn't too dazed to pursue. "What are you saying? What gave you that idea?"

"Doctor Hippert, on the evening news. Didn't you see?" She set her cases on the car roof, and rummaged for keys. "No matter. You can catch it at eleven."

"I never gave him—" His indignation swerved back to the primary problem. "Sara, I didn't know what the operation could do until I spoke to Hippert. I wasn't—Sara, please—"

She responded to the touch on her shoulder with a wheeling swing. John fell hard to the asphalt, a red handprint already burning on his cheek. He stayed down until her car was out of the lot. He opened his cases, and sighed. He'd protected them satisfactorily, at the cost of a nasty sting in the small of his back.

He spent his drive home searching for some way he could have said something to make her understand. The idea hadn't blossomed in his head until Hippert's impromptu lecture on the technology. Until then, he had only suspected, hoped . . . and probably used Sara to explore that hope.

Great. He was a jerk, a jerk who could now forget kindling anything with Sara Weber. No, she was a musician, too. She could understand. She would, when he got the chance.

Probably.

He didn't recognize the car parked

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in front of his house, but the man standing by the door was unmistakable. What, had he heard too? He left his auto parked outside the garage. "What can I do for you, Doctor Nikisch?"

"Let me in, I suppose. Oh, I sent away some journalist who was skulking about. Did she find you at rehearsal? No? You don't seem disappointed."

"I'm not." John lit up the living room, unsuccessfully offered Tadeusz a drink, and sat heavily on the sofa, violin and bow in his lap. "I know what you're going to talk about, so go ahead. Apparently I'm the only person who didn't watch the news tonight."

"Fine. I will go ahead and apologize, for wounding your feelings so badly two weekends ago. I belittled your frustration, and impelled you on a desperate path which I hope you will now let me lead you off."

John held still and quiet for a long time. "I believe I'm honored, Doctor Nikisch, but . . . can you help these?" Shaking hands bracketed his ears. "Your conclusion hasn't changed, and shouldn't. I don't have the ear for violin, but maybe I will soon. If you do understand my frustration, you know how much this would mean."

"John, John, to run such a risk with your body, for so modest a gain, is not right."

"Would you say that if you had the flat ear? If you didn't have the natural aptitude to match your dedication and love? You're so accustomed to your gift, you don't see the chasm it opens between us."

"But I do, John. I have for a long time." Tadeusz clasped his hands. "Tell me, particularly, what this operation will give you."

"Simple. Better hearing. Perfect pitch, keener volume discernment, every improvement technology can provide."

"Ah. An artificial approach to a natural phenomenon. It misses the point."

"No it doesn't. There's no barrier between the two. We stretch gut and nylon strings over an open wooden box, but somehow that's natural while silicon circuits aren't."

Tadeusz let out a short breath. "I should know by now how firmly you make up your mind." He stood and walked slowly toward the door. "I just think you should ask yourself what you may lose from this, against what you might gain. Consider whether you should hold onto the gifts you have, rather than grasping at 'might-be' and 'want-to-be.'"

"Doctor . . ." John followed, never closer than two paces. "I'm sorry that we always have to disagree. I admire you, and respect your advice . . . but I cannot take it."

"Not even to reflect? Then I would also be sorry." Tadeusz left, walking into the night.

John watched him until his car disappeared around the corner. He walked without caring where his feet carried him, but they knew to bring him to his study. He dedicated this room to music, both for application and contemplation. He picked a Beethoven CD off a shelf, programmed the stereo to play the "Pathétique," and dropped into the soft chair.

Music itself was artificial, he

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thought, in any form beyond the banging of rocks and sticks, or the blowing through hollow reeds. It was the rising sophistication of artificiality that gave music its growing richness. Without it, what would there be worth hearing, by anybody's ears?

That premise granted, artificial hearing was the next reasonable step. Who would begrudge a music lover a hearing aid, after all? Without a discerning ear, no music could work its magical effect, just as notes on a page said nothing without an instrument to voice them. Composition and performer.

With him, the chips would become both. They would perform for him, making the music new as the first day on Earth. He would pour the insights that flowed thence into his performances, his proficiency redoubled, reborn. He would play as the instrument of his brilliant new perceptions.

He dimly perceived the music entering its second section through a bone-deep chill. Was that Tadeusz's dread? Might the implants hold him in thrall, enslaved to his new senses, his individuality drowned in technical perfection? He shuddered to imagine a machine guiding his fingers . . . guiding a piece of his soul.

John willed the fears away, rebuking his own egotism. If he began producing great music, wouldn't that addition to the world's joy be enough itself? He couldn't claim exclusive credit for what he played now. Not with a Lupot violin and a Tourte bow, instruments that won their own justified praise, independent of any musician.

Could he be content as an instrument? No, he wouldn't need to. Concert violinists were more than ears: they were repositories of practice and study, knowledge and love. No implant could make a musician, any more than the fretsaw made the violin. The will and the skill would remain his own. He needn't fear that.

Still, he feared. His brain laid open, fragile nerves prodded, mutilated, destroyed. Or if Hippert didn't err . . . what if the gain weren't all he hoped? He was staking the bulk of his worldly goods on the wish that music could lift him beyond worldly concerns.

The known and the unknown. Conventional man that he was, Doctor Nikisch held to the known. It was their musical common ground, the old esteemed above the modern, Bach over Bartok, Schubert over Stravinsky. John was the more adventurous of the two . . . but would he be if he could never go back to the "Pathétique" after hearing "The Rite of Spring"?

The last low chords of Beethoven reverberated, and faded. John sat in silence, as the stereo shut itself off. He longed for bed, for sleep swept clean of the tumult of a decision yet unmade. It would haunt him for years if he said "no," tempt him in his darkest moments. Too great a decision, for anyone.

John remembered his violin and bow, still on the living room sofa. He trudged downstairs for them, but a small red blink turned his eye. Had he missed the message on his machine earlier, or had Beethoven and his own turmoil blanked out the phone? Thinking of Sara, he

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lunged for the "play" button.

The voice that replied was professional and measured, and so polite. It sounded almost sorry that they didn't require a second audition from him, almost sincere in its good wishes for his future career. It hung up, and the following silence was that much more articulate.

John swallowed hard against the clog in his throat. He'd imagined the wound healed before they opened it. He stood motionless, quietly bleeding pride until the pain broke through. When that paroxysm passed, something new remained in its place. With a slow calm covering all else, he retrieved his possessions and walked upstairs. He could sleep now, having chosen which phantasms would bedevil him in the night.

"Do you hear me, Mister Button?"

John wanted only to sleep more, sleep eternally, but the urge ebbed along with the anesthetic. He turned his head, discovering an ache beneath that ear. Turning the other way brought a twin throb, so he gathered all his strength and sat up.

"Easy." Doctor Hippert slipped a hand behind John's back. "Are you all right?" After waiting an uneasy second, he snapped his fingers, turning John's head. "You gave me a scare."

"Sorry." John strained. "I hear you.... normally." There was some elusive difference. Was it the fog still rolling through his head?

"Do you feel up to some tests?"

John didn't, but he took the request as an order. He placed the bulky headphones over his ears, surprised at the feel. He'd forgotten they had shaved there; hopefully there wasn't a mirror in the room. He plodded through the tests, nodding, raising left and right hands, identifying tones as higher or lower. He performed with half-conscious confidence, still not awake enough to be anxious.

Hippert lifted the headphones away, smiling. John didn't return the smile. "It's a success, John, all around."

"Really?" He still felt no different, except for the haze slowly parting.

"Really. Your intensity discernment has improved twelve decibels. I could go into the corner and whisper, and you'd still hear me. Your range is about half an octave broader on either side. As for pitch discernment, you tested perfect."

"I did? I did." The corners of his mouth curled. "What was that tone, the first?"

"The control? Middle C."

John looked to the ceiling, concentrating, and reproduced the note. He sung, hummed, whistled. Hippert put one headphone on his ear, pressed a button on the console, and nodded, but John saw none of this. He was climbing up the diatonic scale, committing each note to memory.

"Where's my violin? No! My CD player."

Hippert changed course, and got John his portable machine. He had a disc already inside, a selection made for the drama he anticipated this moment would hold. He went under the headphones, started the player, and began softly humming four notes over the first few seconds of faint static.

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Three G's and an E flat. Dah dah dah duuuuum. . . .

He galvanized with the violin crash, unwittingly shouting. His smile radiated joy, but slowly began to change. Bit by bit, his mouth fell open, nearly as wide as his eyes. "Oh my. . . ."

Few things enchanted like a waltz. That hadn't changed in ten years, since his first operation. His bow skipped across the strings, while his mind soared, twining in and out of the melody. He could sometimes forget the concert hall, the other musicians . . . but never for long.

The conductor of the state orchestra was finally content with their tempo, and called it a night. John scrunched in his seat to let the lead violinist past before heading for the exit himself. He found his car, next to the sign proclaiming the upcoming "Mostly Mozart" night, and started home.

The drive to his apartment was a long one, full of time for somber ruminations. His career stood at its natural plateau, to rise no farther. Old hopes were a quiet torment, now and again rising to become waking nightmares. He felt it coming again tonight, felt powerless to halt the cataract of pain.

The worst of it was, Doctor Nikisch had been wrong. The implants had worked; not as he had expected, not better or worse, just different. New doors of perception swung open, and through them he had blazed into the top stratum of his art. Tadeusz had lived long enough to see the glorious rise . . . and the fall.

Not a fall so much as too feeble an ascent. Musicians thronged to Doctor Hippert's operating room, and those of other doctors who accepted the overflow. Traditionalists like Nikisch either changed their attitudes or fell into mediocrity, grumbling about the unhappy state of modern performance.

Had John been alone, he would have been the virtuoso of his age. He was instead the first, and those who followed gained the benefit of their doctors' experience. John, his resources never wholly replenished by his brief supremacy, found an upgrade slightly beyond his means, then somewhat more so, then more so. By the time he considered selling his Lupot to raise money, it was no longer enough. By the time he nerved himself to sell the house, all it did was halt the slide.

He didn't bother imagining that another operation could rescue him. He'd learned his lesson; each day he spent around ambitious young violinists, all straining to move up a chair, reinforced it. He feared the next surge, the tide that would wash away his ability to earn a living playing his music.

He longed for home, where he might spend the hour or two before bed listening to something. He despised the earphones, but his neighbors had no patience for his hobby. If only they understood; if only it could reach them as it did him . . .

. . . Occasionally, whenever the evanescent gift of rapture surmounted recollection of the price. ■

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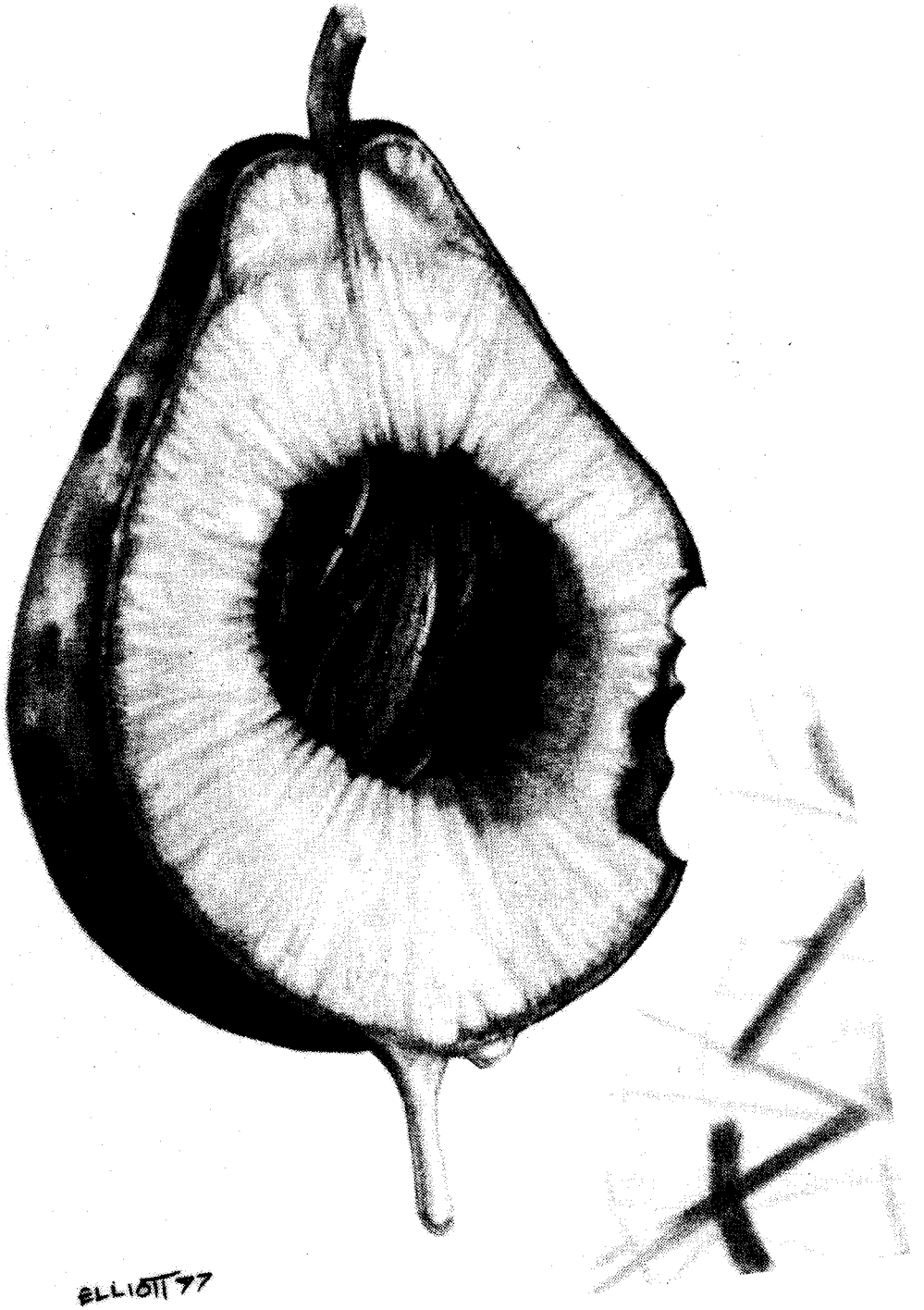

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Paul Levinson

THE ORCHARD

Evidence of things past may be much subtler than expected. . . .

Illustration by Darryl

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The wind blew through the fruiting trees on the hill. Branches sagged with their burden, scenting the air with invitation, attracting moths that flew and climbed and crawled and penetrated. Soft things fell to the ground, opening and oozing, calling forth more of the world around them.

It had been a long time since intelligence had set this in motion. Yet once there had been just a scraggly sapling or two on this hill, thin hints of things to come; later replaced by careful, deliberate rows of the bearers of luscious gifts. And after the initiation, intelligence had continued to tend this. Arranging with some logic the moldering leaves that fertilized the ground. Discouraging parasites, large and small, that would attack the trees, or plunder the fruit, dismember their beauty, before their time. The trees were bred to take countermeasures, take care of themselves. . . .

And when the intelligence left, the trees carried on. More went fallow than under watchful eyes, a branch on this tree went a bit wild and choked out another. Thirty percent eventually died, twenty percent new growth sprung up in unordered places, but the trees carried on. As they had been intended to do. They had not the perception to miss their guardians, nor the capacity to do anything about it even if they had. But they continued. Fruiting for a quarter of their planet's revolution around its star, leafy green the next half, barren in the wintry season. Fruiting, leafy, barren. . . .

And one day, another flying thing came out of the sky. . . .

The story of this expedition had been told long before the technology existed to make it possible. Humans achieved faster-than-light travel—artificial wormholes punctured Einstein's conservatism about speed-of-light well before the end of the 21st century—and by the 22nd this had been developed into a more advanced "snake hole" system that could intelligently route a star craft just about anywhere within a 200-light-year radius from Earth. This newly accessible sea of stars and planets became to the human species what Earth itself, a sea of continents, had been since Magellan's voyage in the 16th century. And the search for intelligent life was on.

Life it turned up aplenty. A bumper crop. Teeming, colorful, DNA-based, locomotive, photosynthetic, and more—the whole enchilada—but not a speck of it like anything humans would call humanly intelligent. The cognitive abilities of even chimps and dolphins were utterly lacking in the exo-phyla catalogued by the human teams dispatched to Earth-type planets around foreign suns.

And so the story of this expedition was old—another ship in search of the bright elusive butterfly of intelligence in the cosmos. Another team eager to award the appellation of human-level intelligence to some deserving species.

It was lonely at the top.

Deborah Sung-Lee was chief of the five-person first-skim team. Her

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specialty was cognitive exo-anthropology—anthropology having evolved to mean not just human but intelligent by this century, an odd linguistic turn considering that its new extended subject had yet to be discovered in reality. In truth it was more a hope than a description of a discipline.

The purpose of this first in-person encounter with the fifth planet of Beta Hydri was textbook tech-check: a thorough scan and sniff and sift of the planet's land, air, and water for any sign of technology, any imprint of the peculiar kind of order that ran both counter and parallel to that of living structure. This meant a hunt for any perturbation of nature, even a discoloration of the soil that humans could take to be evidence of intelligent intervention in the course of things.

The first possible candidate she found was death.

Hers.

Martin Kendrick—exo-fossilist, Deborah's lover, and now, by virtue of his seniority, first in command—stroked her face repeatedly, then moved his forefinger from his lips to hers, and whispered good-bye.

He turned to his colleagues. "The book says we get to vote, in these circumstances, whether to leave or continue working here," he said, voice scratchy with emotion. "Your thoughts?"

"The problem, of course, is we don't know why she died," Pavel Chakravarty, the team's DNA statistician, said. "So there's some probability that we could all die trying to discover why."

"Our directive is to look for intelligent life," Jake Venza, macro-ecologist, countered. "Nothing takes precedence over that. Human death on an alien planet, while not unknown, is by definition unusual—it could be the result of alien intelligence. We didn't ask anyone's permission to land here. Maybe the locals got angry."

"If there are locals here with any intelligence, so far they've been invisible," Martin said quietly.

Pavel made a show of consulting his pad, even though he had memorized the relevant numbers. "Deborah's is the 17th death out of 961 humans exploring worlds outside of our Solar System in the past 76 years. Seven were from natural causes, three from technological malfunction or accident, seven from local conditions—disease, predator, food initially judged to be edible turned out otherwise. Actually, that last sub-category can also be considered technological malfunction, at least in two cases. But, in any event, none of the seventeen were the result of any known alien intelligence at work. We have no reason to think that's what's going on here."

"Not the point," Jake said. "Of course we have no positive reason to conclude that Deborah was deliberately—or even accidentally—killed by some intelligence. But surely her death is more significant than nothing having happened here at all. Surely we'd be idiots not to take that into account."

"We're taking it into account right now," Martin replied.

"Pavel, what do your figures show about our work intersections on the planet?" Susannah Ring asked. She

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was the not-unusual combination of medical officer and exo-botanist for the group.

Pavel looked at his pad in earnest this time, punching in some numbers. "OK, in the nearly fourteen earth-weeks we've been here on Beta Hydri 5, we've done sixty-seven different tasks outside, or the same tasks in different places. Minimum overlap for Deborah was two—she never performed a task alone, none of us do—and her average is 2.7. Her overlap on consumption of native food—leafy vegetables, tubers, stems, all tested as thoroughly compatible with human digestion, of course—is also right near the group mean, by the way. Deborah ingested nothing that at least two others of us haven't also."

"Not much help there," Jake muttered.

"Well, no, that does suggest some sort of internal natural cause," Pavel said. "And that assists us in knowing that this planet was likely not responsible for her death."

"So why are you so eager to leave?" Jake shot back.

"I'm not eager, I—"

"That's enough," Martin interrupted. He looked at Susannah. "Your figures are likely the only ones that could really tell us something here," he said.

Susannah sighed. "I can't conjure up answers where there are none. Her heart stopped, sometime in the middle of the night, apparently when she and we were all sound asleep. She hadn't performed any kind of dangerous, even stressful work before. She was apparently in perfect health, so she wasn't hooked up to any night monitors—which would have woken me immediately when her heart stopped."

"Well, we're not making that mistake again," Martin said.

Susannah nodded. "Yes, now that we're each hooked up every night, we won't be taken by surprise like that—and I can revive someone whose heart stops. So can Pavel if mine's the body in distress. But as to what caused it in Deborah? Whatever it was, it left no trace. So either it was some kind of short-lived, deadly poison, like curare, or her heart just stopped of its own accord. That's been known to happen. An essentially meaningless death."

Martin winced.

Susannah touched his shoulder. "I'm sorry—"

"It's OK," he said. "I think it's time to vote. Any last comments?"

"I say we stay," Jake said.

"Pavel?" Martin asked.

"I've made my position clear," Pavel said. "Deborah's death means the risks outweigh the possibilities here. We ought to leave."

"Susannah?"

"I'm with Jake," she said. "We don't know enough about Deborah's death to leave yet. We owe it to her to try to find out more—or, at least, to make her sacrifice worth something by maybe finding something of interest here—finding some mark of intelligence. That's what we came for."

Martin looked back at Deborah. His was still the decisive vote, he knew, because the rules said that in case of a tie in such circumstances, the side

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with the team-leader's vote wins. Forgive me, he said to himself, and to Deborah. I haven't been leader long enough to know what's good for the group as a whole—only what feels right to me.

"We stay," he said. "I don't want Deborah's death to be meaningless."

"You're looking at the top of the line on this planet." Jake pointed to images of what looked like small, wine-colored cheetahs darting in and out of the screen, the cream of three more months of reconnaissance and recording on four continents and the water around them, some 150 separate sojourns in all. "That's the most intelligence we've seen." Jake's specialty was correlation of morphology, motion, other external characteristics to analogs on Earth. He was also known for an uncanny capacity to pinpoint DNA patterns from surface characteristics.

"Cats back home have a lot of intelligence," Susannah said. "I've seen documented accounts of leopards stranded on islands learning how to fish. But no one's ever seen any evidence of tools or language."

"None here either," Jake agreed. "Not so much as a pile of rocks in an x or a circle."

Susannah bit into one of the fruits they'd recently found nearby. Blend of apple and plum in a peachy flesh, with maybe an edge of piquant cherry, she thought. Tested out as thoroughly edible, confirmed now by a week of eating and no ill effects. Her mouth watered at the sour sweetness.

"So we'll do a few more macroscans," Jake went on, "but we might as well go full steam on the DNA mapping now. No techno-intelligence in the life forms, no signs of tangible technology left behind, all we've got left to look for is some sign of manipulation in the genes. Though I'd be stunned if Pavel found any evidence of engineering there. Everything fits together too naturally on the surface level."

Susannah closed her eyes, massaging a thread of fruit in her molars. "It's a lovely world—at least as nice as the one around faraway Eta Pegasi. Fine array of life, full complement of plants, invertebrates, vertebrates. Air's sweet, no apparent bacteria, viruses, or retros that our immunes can't handle. Lots of water, local food is humanly edible; but no damn species around resembling humans, not even a monkey, no one to offer a commentary on the food. Same story as everywhere else."

"Well, not exactly the same, not for Deborah," Jake said.

"Yeah, I didn't mean—" Susannah said, opening her eyes.

"I know," Jake said. "But maybe this does mean that Deborah died of natural causes after all, and we should count our blessings that there's no intelligent life out here to get us."

"Well, I'll take the risk of competition that companionship brings—I'll take that over being the only intelligent life in the universe—any time." Susannah shivered, even though the temperature in their dome was as comfortable as a summer day in her native New York State, just a degree or two warmer than outside. "We've found more than enough worlds for

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human habitation," she added.

"'And the human being a Miss Lonelyhearts in a sea of starry possibilities,'" Jake quoted from a song that had been a classic for at least two decades back on Earth.

Susannah nodded. "I think it was different back in the old ages of exploration on Earth. I think as much as the conquistadors, the imperialists, had contempt for the natives they found, the very existence of these native humans confirmed for the outsiders that humans had some kind of legitimacy to be there. We've been searching for nearly a century for that sort of confirmation."

"Martin says we may be coming up empty because our search criteria are wrong."

"What else could they be?" Susannah asked.

"I wish I knew," Jake said. "I wish Martin knew. He'll likely come up with an answer on our way back home—after he's pressured us to leave."

"Jeez, is he starting in with that again?"

Jack nodded.

"Martin's a fossilist," Susannah said. She bit into another fruit. "He's trained to see things after the fact."

"Martin's a fossil," Jake said, and they both laughed.

"Here, try this." Susannah pressed her oozing, half-eaten fruit onto Jake's lips. "This apple-plum, or whatever it is, is delicious."

"I still think looking for gene-splicing when we've got no evidence of laser, or any other significant cutting technology, is a waste of time." Martin was feeding huge gobs of data to Pavel on their two-person machine—two inputs, one screen, set up on a table by the window on a beautiful morning. It came programmed with complete genomes of 50,000 representative Earth species. The real knowledge it offered, though, was not in the genomes themselves, but in the patterns among them—the relationship of any one genome to those of the species presumed closest to it in evolution. These similarities and differences amounted to a road-map of natural selection on Earth. An auxiliary module of 15,000 additional genomes from a dozen exo-sources—the sum of those thus far extensively sampled by humans—yielded patterns highly analogous to the ones of Earth.

"Well, I'm inclined to agree with you," Pavel replied. "But you're the one whose vote decided that we stay here, so as long as we're here, where's the harm in proceeding?" The data Martin was putting into the system had been genomically analyzed—the distillate of some 700 local species, bacteria to fungi to grass and trees and froglike creatures and the wine-red cheetahs, harvested and continuously assessed over five months. The relationships among its genomes had been computed to a faretheewell, and were now undergoing summating comparison to the baseline biomes of Earth and the exo-data from other places. Striking gold would be finding a discontinuity in the biomes of this Beta Hydri planet

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and the patterns of Earth—such as the presence of some bacillus or plant DNA in the genome of a vertebrate, or better yet, vertebrate DNA in a bacterium, where it had no apparent naturally-selected business being. This, at the very least, would indicate a weird alien evolutionary trajectory well worth pursuing in its own right. Or it could be evidence of intelligent technological intervention on the genetic level.

"All right, I think that does it for the data input," Martin said. "Look, it's not that I enjoy being our resident pessimist. And you're right that it's on my shoulders that we're here, but we won't be here forever."

"Good," Pavel said. "Deborah's death unnerved me—I guess I hadn't had any experience like that before. Everyone returned just fine in the two other expeditions I was part of. But now . . . I still don't feel right being here. I'm going to get into a safer line of work when we get back home. As much as I love knowledge, I love life—mine—a little more."

"Nothing abnormal about that," Martin said. "At least no one else has suffered any calamity here."

"So far," Pavel said.

Martin rubbed his eyes. "That's why I want to make sure the time we have here is put to best use. All research has value, of course, if only in once in a while turning up the unexpected. I suppose we could be on a world that once had intelligent, technology-wielding life with gene-splicing capability, and they and their equipment long since vanished, leaving behind only the organic results of their genetic engineering. In that scenario, what we're doing here now could uncover something."

Pavel nodded, nose back to the screen now. "But we know from Earth experience that genetically engineered organisms left to their own devices in the biosphere tend to blur into the natural in the long run—tend to lose their unique DNA to natural selection, a sort of regression to the mean via evolution." He shook his head, pulling back from the screen. "Nope, you were right in your first instinct. Nothing here—the full comparisons will take a few hours to detail to the standard degree, but I can see already that we're dealing with the same genomic relationships we have on Earth and the other planets."

Martin frowned. "We're going about this the wrong way."

"I'm all ears about the right way," Pavel said. Now that he had turned away from the computer, he permitted himself one of the sweet fuzzy fruits. He punctured its ripe skin with his front teeth, and let its taste ooze over his tongue. "Mmm. This one reminds me of mango in some way." He smacked his lips. "This almost makes our trip worthwhile all by itself. It's popping up along most of the western shore of this continent now."

"You know who Heidegger is?" Martin asked.

"A fruiterer, right? No, I know who he was." Pavel chuckled at his own joke. "I'm a little rusty on my philosophy of science, but he was what, late 20th, early 21st century, Viennese contemporary of Freud?"

"Almost," Martin replied. "German, and did his major work just a bit after

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Freud—mid-20th century."

Pavel nodded, tongue playing with the torn skin of the fruit.

"Anyway," Martin continued, "he defined human existence as not so much intelligence, but intelligence aware of its own existence and seeking to rearrange the furniture of the world to make it more comfortable for its pursuits. That rearrangement was, in a word, technology."

"OK," Pavel said. "Makes sense. Patkar in India published something along the same lines, oh, some fifteen years ago, I think."

"Right. It's an oft-researched theme. But Heidegger's real originality was his insistence that we could understand the workings of human intelligence only from the inside out—starting with the thinking subjects that create technology—rather than looking at the technological artifacts."

"So how does that apply to us here?" Pavel asked. "We're busy looking for technological artifacts, products of intelligence, when we should be looking for what—the inside of the minds that made them? How do we do that? We haven't found any organisms that seem to have minds—Jake's come up as empty as we have." His teeth made clicking contact with the hard pit of the fruit.

"I'm not sure," Martin replied. "I guess we'd need to know their taste in furniture—how they'd want to rearrange their world. But let's say they were minimalists, unlike us, and didn't want to change their world too much, if at all. That could be why we don't know what to look for. That could be why there doesn't seem to be any evidence of their intelligence."

Pavel sucked the fruit pit—it was mottled with wavy grooves and riverbeds, like a peach's. He rolled it around on his tongue, wrapped his tongue around it, teasing and jabbing the underside of his tongue with the point of the pit till his eyes watered with pleasure. Then he took it out of his mouth with his fingers. He held it up to the window so that it blocked out the top of a nearby tree. "Also could be that there isn't any evidence because there wasn't any intelligence," he said. "That's the more likely explanation. You know, if we found a fruit without pits or seeds, that would almost certainly be good evidence of technological intervention, and recent at that—seedless varieties, after all, wouldn't last on their own. But all of these delicious fruit have pits." He flicked the pit in a long arc and just missed making a basket.

Martin had worked with Deborah on three other discovery expeditions, and had heard her talk many times about how they all seemed to progress in a similar pattern of stages. You arrive in a new place, everyone is bursting with energy and conviction that great discovery is at hand. Then, as test after test fails to deliver what you came for, your work changes from excitement to work—you grit your teeth and hunker down for the long run of tedious probing, testing, repetition. Then one day you realize that the time for departure is almost at hand, and this lights within you an absolute surety that the missing link you sought is just around the corner. You

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convince yourself of the portentous signs of data you earlier rejected. You immerse yourself in a frenzy of activity. If you could just stay a bit longer, success would undoubtedly be yours.

Martin had to make sure that he didn't get seduced by this manic endgame to the point of losing his ability to get his team off the planet at the appropriate time. He had more than enough reason to want to stay here—making Deborah's death something more than another unfortunate statistic, his own half-formed ideas about how the traces of intelligent life might yet be uncovered here. . . . But they'd been six earthmonths on this planet now. And that, plus the voyage out and back, was approaching the maximum the food supplies carried by this size ship could reliably cover. Yes, food on the planet was edible, but edibility and long-term compatibility to human digestion and health were two quite different things.

Susannah had a fruit in her mouth and a thoughtful expression on her face as she entered Martin's quarters. "This one has the velvety kiwi undertone," she said. "Haven't had one of those in a few weeks."

"We'll take some pits and cuttings back with us," Martin said. "Your bailiwick."

"Sure," Susannah said, still apparently distracted with the taste of the fruit. "So that makes this, what, the thirteenth planet with lots of life but no sign of technological intelligence our species has come across?"

"Actually, fourteenth," Martin said. "They finally got around to taking a closer look at the second planet around Delta Pavonis—only nineteen light-years away, don't know why it took them so long—but it didn't matter anyway. No great shakes. More birds than usual. Nothing humanly intelligent."

"Bet they had nothing like this apple-peach fruit." Susannah licked the last of the tangy pulp off the pit.

"No word on its fruit in the report I just saw."

"Hard to believe that fruit this good just happened," Susannah said, "that it wasn't developed to delight a palate that could communicate its delight to others."

"Seems to me there are lots of birds and those chipmunk-like rodents that are doing a fine job communicating that delight to their own kind around here," Martin said.

"You know what I mean," Susannah said.

"I do," Martin said. "But deliciousness of fruit surely isn't a sign of technological intervention—lots of creatures wolf down natural delicacies in the tropics on Earth—bonbons that fuel the workings of evolution."

"What kind of sign of intelligence would you want to see in this fruit then?" Susannah asked. "Just for argument's sake."

Martin shrugged. "The DNA analysis showed nothing unusual. We scanned the trees in the area—for color, size, leaf pattern, the usual indices—up and down and ten ways to Sunday when we first arrived, and then two months later, and came up null. I'd want to see some order, some structured variation in their form—something that spoke of a deliberate

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intervention in their coming to be. But nothing I'm telling you is new. The bottom line is: great tasting fruit is nothing out of the ordinary, however much we may project it to be. The fruit's just great natural furniture. Came with the property. That's likely all."

Susannah squeezed the sticky pit in her palm. Then touched her stomach and grimaced.

"Are you all right?" Martin asked. "How much of that fruit have you been eating?"

On the day before departure, Jake and Susannah went up in the shuttle pod for the customary final macroscan of the neighborhood.

"You look a little better," Jake lied.

"I'm bucked up on stimulants," Susannah said. "There's nothing demonstrably wrong with me, and I didn't want to miss this last chance to look around."

Jake nodded. "You're the doctor. Fortunately for you, there's no way Martin can cite a medical problem as a reason for immediate departure without the medical officer's consent. Nice little loophole. Otherwise he'd have had us off this planet last week. And I don't know that I disagree with him any more."

"Pavel looked me over and pronounced me fine, just tired and overworked," Susannah said.

Jake made a derisive sound. "He's a technician, not a diagnostician. Look, I just don't want you to wind up like—"

"Deborah died instantly—jeez, you don't have to be an MD to tell the difference between that and a little stomach ailment, do you?"

"OK." Jake made a placating gesture. "We're leaving tomorrow anyway, so there's no point in arguing."

Susannah was staring at the fruit trees near their landing site. "Look at that!" she suddenly said. "You see that? The slightly different shades make a pattern of circles and triangles!" She traced what she was seeing on the screen with her forefinger. "Looks like four different shades."

"I don't know," Jake squinted. "Maybe. The lines aren't clean." He pointed to several places where the shades and the faint geometric patterns blurred into each other. "What would it mean anyway? Another lake that looks like a snowflake from the sky? Nature is quite the geometric artist on its own."

"Not like this," Susannah said. "It doesn't look like anything I've seen before. I think this substantiates Martin's hypothesis."

Then she keeled over the console and threw up.

Martin was in the mood for neither an escalating last minute medical problem nor a new project. "I don't see it." He looked again at the recorded images, the patterns that Susannah had pointed out to Jake. "Honestly, I don't. And I don't think we should spend any more time on this. We need to concentrate on making sure Susannah is OK and then leaving."

"Agreed," Jake said, "but why not do the full digital workups anyway, and put this thing to rest? Only take about half an hour, right?" He felt a responsibility to take up Susannah's position in her absence.

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Pavel shrugged.

Jake pushed on. "This could be the rearranged furniture you've been musing about for the past month—fruit trees deliberately planted in geometric patterns. Low-tech, but tech, not nature."

"We don't have the time," Martin said. "We've had six months here to do this—"

"The trees were barren when we arrived," Jake said. "They've achieved full fruiting maybe just the last two weeks."

Martin shook his head, tempted, undecided. "Susannah's feeling a little better, she can travel now, " he finally said. "I think it's time to leave."

"But we can't be sure that Susannah's not going to get worse," Jake insisted. "You know that. And a fundamental rule here is that you don't leave a planet when a member of the crew has an unexplained illness. You don't want it spreading. The planet itself may have the only cure. Lots of reasons."

"Who says it's even an illness?" Martin said. "The tests turned up nothing. It's probably just exhaustion—"

"And you're so sure the tests could spot an alien bug?"

"All right. All right." Martin held his hands up to indicate an end to discussion. "Pavel, do the image workups, as quickly as you can, please."

"OK," Pavel said. "Meanwhile, here are the data you asked for this morning." He punched up the results of the analyses he had taken for the past week from the chemical conversion facilities that served as toilets. "These statistics speak for themselves—the four profiles are almost identical," Pavel said and hurried off.

Martin regarded a part of the big screen and shook his head some more. "No real difference in the amount of the fruit each of us has eaten," he said. "Damn, I still think the fruit has something to do with this. That was truthfully my first thought, after the obvious possibility that she was pregnant, which the readings show conclusively she isn't."

Jake tried to ignore the pregnancy jibe, which he knew was aimed at him. "Well, fruiting's of course a kind of pregnancy too. The fruit attract digestive systems to deposit the seeds in a nice warm mound of fertilizer somewhere. But, then intelligence comes along, also prizes the taste of the fruit, breeds the trees, but throws away most of the seeds! Doesn't matter to the trees, though—their new benefactors will keep planting trees to keep the good taste coming. Untended nature, deliberate intelligence—the trees and their fruit win either way."

"Yeah," Martin replied. "But where's the evolutionary benefit to the trees in making one of us sick?"

Pavel returned twenty minutes later with image enhancements and a fistful of data. Susannah was with him. Martin started to object, but thought the better of it. If he could convince himself and Jake that all that had gotten to Susannah's stomach was nerves or fatigue, their departure would be that less nerve-wracking.

"OK, we do have something here, four distinct shades all right," Pavel said. He traced the patterns Susannah

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had seen, much clearer now under enhancement. "But they're really just on the edge of what we could call a structure. See? It breaks down here, here, here, here, and here." He fingered five swirling places where the colors from one section bled into the next to the dissolution of the pattern at those spots. There were more. "I mean, yes, if you have three straight lines almost touching each other at angles, then we can say we have a triangle. But if one of the lines has a gaping hole in it, and another is all wiggly and messy to the point where it's not even really a line, then we get to the point where calling it a triangle may be going too far. I think we're just at that cusp here—there's a very high noise-to-signal ratio in this pattern."

"Hell of a garbled way to send a message to visitors from outer space," Martin muttered.

"It's not a message, it's not a math screen, it's not an abandoned factory," Susannah said. "I think it's an orchard. A living community. Members die, new members come up over time. Of course the original blueprints of its planners get blurred."

"Orchard?" Pavel's ears perked up. "But I assure you I thoroughly checked all the DNA of these fruit. There's nothing that looks engineered there."

Jake shook his head. "DNA's not the only indication of intelligent management of life. That's the way it's been done for the past few centuries on Earth, of course. But for thousands of years before that, people deliberately bred crops—and animals—the old-fashioned way, to bring out whatever favorable characteristics. In that kind of macro-program, you won't find sharp discontinuities in the DNA."

"Artificial breeding, Darwin called it," Susannah said. "And Luther Burbank changed the face of world agriculture with it in the early 20th century. The last hurrah of pre-gene-spliced agriculture."

"Look, I want this as much as anyone," Martin said, "but we're out of time here. And now that Susannah's feeling better—"

"Out of time for detailed testing, but not out of time for us to look for something more for you to mention in your report," Jake said. "If you give the wrong spin to what Susannah thinks we've discovered here, to what you yourself have been edging towards with your Heidegger talk, it could be a century or more before any other team comes back here—too many new worlds elsewhere. And by then, who knows what shape the, ah, orchard will be in."

Martin spoke through clenched teeth. "I've got to be honest in my report. Politics change with the seasons, you know that. We're high-funded now, all that could change with the next election. If I encourage another expedition on the basis of what we want to see here, rather than what actually is, and they come back disappointed in a time of fiscal tightening, that could hurt the search for exo-intelligence very badly."

"That's why I want us to try to come up with more," Jake said.

"With what?" Martin asked.

"How many other patches of these fruit trees have we seen on this planet?" Pavel asked.

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"Dozens," Jake said. "They're all over the coast."

"But none have any geometric designs," Martin said.

"That's because we scanned them prior to full fruiting," Susannah said.

Martin scowled. "OK, look: We have a half-baked four-color scheme on a bunch of trees that bear tasty fruit that just happen to be near us. We need to correlate that color scheme to some kind of tangible difference in function. That's the way intelligence would work, if it planned this. Otherwise, the colors are just so much natural smoke and mirrors. Fractals show that sometimes nature imitates technology."

"I agree about needing to find a function," Susannah said.

"Good," Martin said. "So let's think about it. I'm open to any ideas, really I am. But we leave tomorrow at 0900 hours."

The camp was struck, the ship was packed, departure was imminent.

Pavel was making love to a last fruit. "Truly wonderful," he said. "This one has a light strawberry finish. Martin, you could say in your report, with no lie, that this planet is worth another visit just to taste the fruit."

Susannah snapped her fingers. "Taste. Taste! That could be it!"

"We've already been over that line of argument," Martin said. "Don't tell me again that delicious fruit equates with deliberate planting."

"No, no, I mean *variety* of taste," Susannah said. "That could be the function that correlates to the colors. I remember an old apple orchard near where I grew up in New York—had all sorts of yellow and green and usual red apple trees laid out in sectors to make harvesting of each variety easier. And of course the planters went to that trouble because people prized the tastes of the different apples."

"So how many tastes have we noticed with this delectable fruit?" Jake asked.

Pavel closed his eyes in the enjoyment of remembrance. "Well, they're all evocative of apple-plum, as you know. But let's see. We have one with a tart cherry touch—"

"My favorite," Martin said.

"Mine too," Pavel said. "And one with mango—"

"Don't forget the kiwi," Jake said.

"Right," Pavel said. "And this strawberry." He took the pit out of his mouth and used its tip to clean some tartar off his teeth.

"That makes four," Susannah said. "Four distinct flavors, four distinct shades in the planting."

"And the planting's in a geometric pattern," Jake said.

"The pattern's barely discernible, we don't know it's a planting," Pavel said.

"We don't even know if the colors correlate with the different tastes," Martin said. "Could be two unrelated features."

"Let's find out," Jake said.

"How?" Martin said. "By going out and tasting every fruit?"

Susannah thought she saw Pavel's eyes light up for an instant.

"Not necessary," Jake said. "I can run a macro on the enhanced color images of the orchard. I can pinpoint a few handfuls of sampling areas.

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Won't be 100 percent conclusive, of course—no sample ever is—but it should give us a decent statistical assessment of the proposition that color correlates with taste in that fruit. Something you can put in your report. Fair enough?"

"We don't have the time," Martin said. "No one seems to understand that we've got to get off this planet—today—if we want reliable amounts of food for our voyage home."

"Fifteen minutes to run the macro. What, an hour to do the tasting? We have time for that," Jake said.

Martin shook his head, this time in resignation. "Barely. All right. Do it."

"Tasting under pressure of blind survey isn't the same as natural tasting," Susannah said. "People get nervous, they're not sure what they're tasting." She rubbed her stomach.

Jake noticed, said nothing.

"I never liked the arbitrary nature of statistics," Susannah continued. "One probability level for significance if you're testing a brand new drug; another if you're confirming the value of an old one. What level of correlation is indicative of significance here? The figure you proposed certainly seems reasonable—but what's reasonable when the stakes are possibly the first signs of human-like intelligence anywhere in the universe other than Earth?"

Jake put his hand over hers. "We should have the results in a few minutes. Pavel bit into a fruit that was rotten on one side, and that threw his taste off. Had to wash out his mouth, choose another fruit—so we lost about five minutes."

"Jeez," Susannah said. "The sample's so small that the entire finding of significance or not could come down to that one damn peach—and the accuracy of Pavel's taste buds."

"So let's hope he's not taste-blind," Jake said.

"Yeah," Susannah said, and brushed a clump of hair, matted with sweat, from her forehead. "I'll feel better when we have the results—as long as they turn out positive."

Martin and Pavel walked in four minutes later, bearing fruit in their hands and big smiles on their faces.

"Care for one of these?" Pavel offered with a flourish.

"Why, of course," Jake replied with a courtly gesture. "Tart cherry. My favorite."

"The taste of intelligence!" Martin whooped.

Everyone joined in and applauded.

"Thus might the future course of humanity in the universe be changed," Pavel intoned. "It was close. But the result of our double-blind, stratified random sample is clearly over the significance line: taste, the function, correlates with color, which in turn is laid out in rough but discernible geometric patterns. This of course all could still be accidental or natural—we have no *hard* proof that it isn't, just a statistical suggestion—but it's a start."

"Difficult universe," Susannah said.

"Care to pass some more of that over, for confirmation?" Jake asked Pavel, and laughed. "The one you just gave me was pretty small."

Everyone hugged.

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And Susannah folded to the ground, brown eyes glassy. "Misjudged . . ." she mumbled. And then she went completely unconscious.

"Not good," Pavel said, looking at Susannah's dilated pupil large upon the screen, and the streams of numerical data that flowed like eyewash around it. "She's getting worse."

"She's going the same way as Deborah, I can feel it," Martin said. He savagely kicked a fruit that had fallen on the floor—it smashed against a far wall, juices dripping. "Too much of a price to pay!"

"No, it can't be the same," Pavel said. "Deborah died right away. I mean, Susannah was very clear about that—"

Jake entered the sickbay, grim. "I know what's causing this."

Martin and Pavel looked at him, both exhaling with relief. "So talk to us," Martin urged.

Jake took a deep breath. "I, ahm, I was able to break some of her personal security codes—I guess I knew where to look—and was able to get to some of her personal files."

"And?" Martin prompted again.

"And it's the same thing that killed Deborah, goddamnit," Jake said.

"What?" "How could that be?" "Impossible!" Martin and Pavel were shouting at the same time.

Jake continued, talking more to himself than to them. "So I read most of her files. I couldn't believe it. Susannah's not only a doctor but a botanist. Something in the way Deborah died made her think plant poison—some trees on Earth exude a resin that kills anything that crawls on them—"

"She said curare," Pavel recalled. "That comes from some trees in the Amazon—was used by the people there in poison arrows, right?"

"Yeah," Jake said. "And the poison here is in the bark of the fruit trees. That was Susannah's theory. She tested it on herself—in very tiny doses at first. She identified the poisonous compound and had a way of diluting it. She wanted to see if there was a way to build up resistance, maybe come up with an antidote, in case any one else got exposed like Deborah. But then, she figured that if the trees were the result of intelligent planting, then the poisonous bark wasn't accidental—and there might be an antidote already out there. And she realized that if she could discover that antidote, it would provide really tangible evidence of intelligence behind the trees. She reasoned out what it could be, and her notes say she found it—"

"So what the hell is it—let's give it to her!" Martin bellowed.

Jake sat down, head in his hands. "I don't know what it is—I don't know. I couldn't read that part of her files—she hadn't saved them for even her own permanent record as yet. The last part of this all happened very recently, very quickly. She was sure she had the antidote. She was afraid that our taste test would prove inconclusive. So she took a higher dose of the poison than usual, enough to make her ill, with the intention of offsetting it with the antidote. That would be the palpable evidence. That would give the people back home the proof

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positive to put this place on the map of intelligence. But something went wrong. I don't know. . . ."

"We have to face the fact that maybe she was wrong about the antidote," Pavel said softly.

"It could just as likely be that she didn't give herself enough of it," Jake replied.

"We can figure this out," Martin said. "The first order of business is identifying the antidote. Let's assume Susannah got that right. There's got to be a way we can retrace her thinking. We start with what we know about the trees—socially as well as biologically. They're part of an orchard—"

"Right," Jake said. "And the planters apparently installed some sort of defense system—a poison in the trees—to ward off predators. Like poison ivy back home."

"Yeah," Pavel said, "but we've all gorged on the fruit of these trees, and none of us except Susannah is sick. Maybe she has some allergy to it."

"Jake says that Susannah already established that it's the bark, not the fruit, that's causing the problem," Martin said. "And I remember Deborah did do some work out there in those trees, after we first arrived, before they started fruiting. She was taking DNA samples—slicing off a few pieces of bark."

"So did I," Pavel objected. "We both wore gloves. And I'm not sick."

"So maybe Deborah wasn't as careful as you. We all make mistakes, get sloppy sometimes. Or maybe she sliced into a part of the bark that contained a central tap of the poison," Martin said. His voice choked.

"Look, the planters—whoever created the orchard—wanted the fruit to be enjoyed and eaten," Jake said. "So of course it wouldn't be deadly. But taking off a piece of bark is an act of aggression against the tree—the planters would want any animal that did that to suffer, to get negative reinforcement."

"I'm with you," Martin said. "But how could the planters differentiate, say, between an animal, or even an intelligent vandal, and someone who might have been planting another tree, and accidentally broke off some bark? Surely the planters wouldn't want to poison one of their own?"

"No, they wouldn't . . ." Jake closed his eyes in thought. "Pavel, do you have any image readings on the age of the trees?"

"Age?" Pavel asked.

"Yeah," Jake said. "Can you tell if there are any saplings in our grove?"

"Well, sure, of course," Pavel said, and pulled a sequence of displays on to the screen. "These are very young. And here."

"What are you getting at?" Martin said.

"I'm not sure," Jake said. "But saplings, very young trees, obviously have slightly different chemistries in their bark than older specimens. I'm thinking that one way the planters might have distinguished between other planters and vandals is that the planters would have obviously come into contact with younger trees."

"And?"

"And maybe exposure to the bark of the younger trees confers an immunity, is an antidote, to the poison of

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the older bark," Jake said.

"So what are you proposing?" Martin asked. "Go out and get some bark from the saplings, and rub that all over Susannah's skin? We already know the adult bark's some kind of poison. What you're suggesting could kill her outright! Like giving a diabetic in insulin shock more insulin!"

"I know," Jake said. "I know."

"She'll be dead in an hour anyway, if we do nothing," Pavel said.

Martin's face was almost as pasty as Susannah's. "Your call," he said at last to Jake. "She's—you and she—are more than professional. It's right that you should make the decision. But I guess I'm with Pavel in that we don't seem to have many—any—other options."

Jake returned from the orchard with bark from a dozen of the youngest saplings he could find.

"Should I inject her?" Pavel asked, after the extract had been analyzed. It indeed had a composition very different in several respects from the extract of adult trees.

Jake nodded yes, and Pavel injected her.

Martin squeezed Jake's shoulder. "Courage," he said softly. "Courage."

Susannah moaned. Her body twitched.

The seconds clicked off on a red display. Jake's face bore the brunt of each click.

"Any change?" Martin finally demanded.

Pavel studied the readings, said nothing.

"Pavel?" Martin asked again.

Susannah's body shuddered.

"She's fading," Pavel said. "We're losing her."

"Maybe we didn't give her enough antidote," Martin said.

Pavel looked at a second injector, loaded with sapling extract. "We have one more ready to go," he said. "But wouldn't we be seeing at least some slight improvement already if the sapling is the antidote?"

"Not necessarily," Martin said. "We don't know how this operates. Maybe below a certain level the antidote has no effect."

"Or maybe I was wrong and the antidote's just more goddamn poison and we're killing her!" Jake cried out, and lunged for the injector.

He had it in his hand. He raised his arm, making a show of his intention of smashing the injector on the floor. "Goddam planet—"

But Martin tackled him to the floor first, squeezing Jake's wrist in a hard grip that immobilized his hand and the injector.

Jake struggled, but Martin was the bigger, stronger man. He turned Jake's face to him with his free hand. "Listen to me, *listen* to me," he said. "She would have died anyway without the sapling extract. You and Pavel were right about that. And she's going to die now if we do nothing more. We've got nothing to lose. We've got to try the second injection."

Jake pulled his face away.

"It's all we've got left," Martin continued. "OK?"

Jake's breath was shaky. "OK."

Pavel gave Susannah the second injection.

Her voice made a low, guttural

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sound. Her eyes rolled back in her head.

But five minutes later, she opened them and smiled weakly.

"What happened?" she asked. "We have some evidence that the trees were deliberately planted, right?"

Jake gently stroked her hair, kissed her on the forehead. "Excellent evidence. Corroboration well beyond the taste test. The best evidence in the Universe. Especially now." ■

IN TIMES TO COME

Our lead story for March is a new Sam Gunn novella by Ben Bova. "Tourist Sam" is not exactly Sam up to his usual tricks; it's more (as usual) Sam up to *new* tricks. But then, the job of a tour operator is to give the tourists what they want. Right? Leave it to Sam to put a new twist on things. . . .

Our fact article, coincidentally, is a sequel to one that appeared here when Ben was *Analog's* editor. Duncan Lunan's "Space Probe from Epsilon Boötis" (January 1974) caused quite a stir with its analysis of circumstantial but highly suggestive evidence that somebody may have planted something, quite some time ago, to keep an eye on the Solar System. Now, in "Epsilon Boötis Revisited," Lunan sets forth a whole new web of "coincidences" that dovetail intriguingly with the old ones. (Don't worry if you haven't read or don't remember the earlier article; he tells you all you need to follow the argument!)

Finally, we'll have the usual highly mixed bag of fiction, from a novelette by Michael F. Flynn, to a new "Astral Astronaut" story by Jerry Oltion, a promising newcomer or two, and a Probability Zero.

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Jerry Oltion

WHAT'S IT LIKE?

Many people find fulfillment in their work, but not always the kind they expected.

Illustration by Janet Aulisio

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When a man switches to a woman's body, the first thing he does is feel his breasts. The first thing a woman does in a man's body is pee standing up. There are exceptions, of course, but those are by far the most common reactions. Margaret DeBeau, chief psychologist for the Cognitive Displacement Project, established that in tests not long after they ironed the bugs out of the Tilbey Transfer process.

Of course after their initial solo experimentation the test subjects mated like rabbits, just to see what it felt like from the other side. Margaret wasn't concerned with that aspect of the trial. Interested, in a prurient sort of way, since she needed both hands to count the years since she had last mated like anything; and amused the first few times the subjects blushingly tried to describe their experience during the debriefing after they'd switched back to their original bodies, but she was hardly surprised. People had always wondered what their partners felt during sex. She would have been interested only if they *hadn't* tried it.

The fascinating part of the gender-switching study came when Arthur Brinsley walked into her office a day after they began the extended duration switchover test and said, "Margaret, can I have a little girl-to-girl chat with you?" He was wearing Candi Jenssen's body, and doing a pretty good job of it. No hesitation when he walked, no trouble sitting down in one of the two chairs beside Margaret's desk.

She turned away from the window where she had been watching a caterpillar spin its cocoon on a branch just beyond the glass.

"Girl to girl?" she asked lightly. "Going native, are you?"

He giggled. It sounded exactly like Candi's giggle. Then he blushed just the way Candi did when she caught herself doing something dumb. Something "blonde," she would say in self-deprecation.

"Yes, as a matter of fact, I *am* going native. That's what I want to talk about." He leaned forward in his chair, accidentally giving Margaret a generous view of Candi's breasts. She made a mental note to warn him about that when he was done talking, before he compromised Candi's modesty to everyone else on the project, but the next thing he said blew that thought straight out of her mind. "I can't help giggling," he said. "And preening whenever a man is around. It's like this insane little hiccup the body does without me."

While she'd been watching the caterpillar spin, Margaret had been wondering if anything truly interesting would come of this project, or whether she had merely derailed one undistinguished career for another when she'd joined the CDP team. She had gambled that fringe science would provide the reward that clinical psychology never had, and she had to admit it was a lot more exciting to be on the frontier of something for a change, but so far nothing had quite satisfied her longing for—what? She didn't know. This, however, seemed promising.

First rule of investigation: define the terms. "Preening?" Margaret asked. "Like how?"

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"I don't know, like—" Arthur ran his hand through his hair—Candi's hair, which came down to her shoulders—then flipped it back with a careless toss of his head. "Like that. And I blink like I've got something in my eyes, and I do this silly turn-the-head-sideways thing while I do it." He acted out a cartoonish parody of a woman on the make.

Margaret laughed out loud at the sight of Candi's body doing that. Candi tried so hard to overcome the stereotype that went with her California-blonde looks, and there was Arthur trashing all her hard work in a moment.

"You're telling me it's hard-wired?"

"Apparently. And . . ." he hesitated, blushing again. "And I get all gushy and stupid around Huang Lee."

"Huang Lee? Candi doesn't even *like* him."

"Want to bet?" asked Arthur.

"Sure I—hah. No way." Margaret remembered Candi's first week in the lab, back when they were still getting started with the actual hardware. She and Huang were instant partners, spending long hours calibrating the brainwave recorders and the neural overlay masks, and disrupting the entire lab with their constant chatter—until she had realized he was gay. They still worked together after that, but it was much quieter. Huang had come to Margaret a few days later and asked if she thought he had been wrong to tell her, and she'd told him no, stringing Candi along would have been the worse offense, but Candi had still taken it hard.

That was two years ago. Had she secretly harbored the hots for him all this time?

"Is it just him?" she asked, "or do you feel the same way around anyone else?"

"It's strongest with him, but I'm attracted at least a little bit to practically every man I see." Arthur giggled again. "Except for Dr. Hayward."

Hayward was the project leader, an awkward, cadaverous but brilliant man in his sixties. "What's wrong with him?" Margaret asked anyway, wanting Arthur's reason, not her own speculation.

"I don't know," Arthur said. He absently scratched his right breast, then flinched when he realized what he was doing. "Sorry," he said. "Bras itch."

"Tell me about it. So what's wrong with Hayward? Purely scientific curiosity, of course."

"Of course." He leaned back in his chair. "Hell, I don't know. When I think about it, the whole concept is faintly nauseating no matter who I'm attracted to. There's just no chemistry between Candi's body and Hayward, that's all."

A loud banging on the door made both of them jump. "Yeow! What? What is it?" Margaret asked.

Candi stuck her head in. She was wearing Arthur's body. They hadn't begun three-way swaps yet. "Sorry," she said. "I don't know my own strength."

"I forgot to warn you how macho I was," Arthur said, giggling.

"I'll say. Do you mind if I join you? Or were you discussing something private?"

"Arthur?" Margaret asked.

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"No, it's fine." He looked over at Candi. "I probably should have gone to you first anyway, but you didn't answer your pager."

Candi hung Arthur's head like a boy caught sneaking a peek up someone's dress. "I was outside throwing rocks at the mailbox. It's amazing how good a shot you are."

Arthur shrugged. "I used to play baseball."

"Maybe that explains the spitting." Candi pulled the other office chair over next to Arthur so they could talk in a triangle.

"Spitting?" Arthur said.

"Oh yeah!" Candi laughed Arthur's deep, throaty laugh, then hawked up a major-league goober. She stopped short of gobbing the carpet with it, made a face, and swallowed instead. "It's like this insane little hiccup your body does without me."

Margaret's eyes widened. "You used the same words Arthur did to describe the way he preens now that he's in your body."

"Preens? I don't preen. Do I?"

Arthur answered her with the same coquettish tilt and flip he had shown Margaret earlier, and as Candi stared at him, horrified, he said "I sure didn't learn that from anyone else."

"Oh God." Candi slumped back in her chair, which creaked ominously under Arthur's weight. "Did I—*do* I actually do that?"

Margaret shook her head. "No more than Arthur actually spits."

"Then how come *I* do it?" asked Arthur. "Seems to me it's more of a woman thing than a guy thing."

Margaret already had a theory, but she didn't want to bias her test subjects so she asked another question. "Arthur, you were just telling me that you felt some attraction to every man on the project except for Dr. Hayward. Did you notice anything else about that attraction? Any pattern?"

Candi looked at him sharply, but didn't say anything. They'd agreed ahead of time: no sex except with each other, and with their spouses if the spouses were interested.

Arthur said, "Now that you mention it, I guess I'm attracted to foreigners more than locals. Huang, Abu, Yuri, Lars—like that."

"How about it, Candi—is that normal for you?"

She shrugged. "I don't know. I don't necessarily seek out the exotic, but I don't avoid it, either."

"How about the mundane?"

"Look," she said, a bit exasperated, "I don't really analyze a man's position on the strangeness scale, all right? I go out with the interesting ones, that's all."

"That's *you* speaking. What about your body? For that matter, do you notice anything different now that you're in Arthur's body?"

She looked at Margaret for just a second with a frankly appraising look, and then she said, "Well, now that you mention it, you're apparently not my type. Sorry. You, on the other hand—" she looked at Arthur in her own body "—make my hormones fizz."

Arthur blushed. Margaret looked from him to Candi, and saw her flush. There was a distinct difference. Her pupils dilated and her nostrils flared;

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she looked like she might tear off Arthur's clothes right there in the office if she hadn't had her own civilized mores to restrain her.

"I think that pretty well proves it," Margaret said. "Your sex drives are hard-wired. Your psyches apparently modify things to some extent, but the basic impulses are straight evolution talking."

"How do you figure?" Arthur asked. He looked warily at Candi, who shifted uncomfortably in her seat, then gave up and readjusted her pants to accommodate her sudden erection.

"Candi's body is attracted to foreigners," Margaret told him. "Young ones at that. The best candidates to give her a healthy baby, since with a foreigner there's less chance of inbreeding, and someone young can help care for it. And Arthur's body," she said to Candi, "likes the young, buxom types for the same reason. Good mother material. You've both learned to alter those urges to suit your intellectual tastes, but with the intellect out of the body, that's what you're left with."

Arthur snorted. "But my intellect is right here. How come I'm not still attracted to young, buxom women?"

Margaret steepled her fingers. "Aren't you? What did you and your wife do last night?"

He grinned sheepishly. "Yeah, but that's Ellen. We've been married for five years."

"And you still find her attractive, even in Candi's body. Psyche over instinct. But I think it's pretty clear that consciousness isn't completely one or the other."

Candi laughed. "This is going to piss off a lot of people who were hoping we'd prove once and for all that the intellect is divine."

It might at that, Margaret thought. The religious right had been nervous about the Tilbey process right from the start, even though on the surface it seemed to vindicate their belief in a soul. The idea that the soul could be recorded bothered them, and the idea that it could be transferred from one body to another scared them silly.

Margaret didn't particularly care. She was looking for understanding, not affirmation. Let the chips fall where they may; she just wanted to learn what the chips were made of.

And maybe, just a little, she wanted to try a swap of her own. Not with Arthur, or even with Dr. Hayward, who was closer to her own age. Being a man had never interested her. But being young again, and beautiful for the first time. . . .

She didn't realize she was staring until Arthur said, "What?"

She glanced away. "Arthur," she said, "protect that body as if it were gold. A lot of people would love to get into Candi's pants while her guard is down. Not all of them the traditional way."

He and Candi exchanged a worried look. Then Candi leaned over and buttoned his blouse one notch higher.

They stayed in each other's bodies for a full week, and in that time they learned quite a bit about their instinctive versus learned behavior patterns. Plus they tried another experiment: Arthur taught Candi's body how to throw, and she taught his how to play the piano. When they switched back

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they tried it again, and discovered that some of the learned behavior stayed with the body. Maybe it was just aptitude, but the cellular memory theorists had a field day with it.

So did the press, but Margaret didn't pay any attention to that. She was already gearing up for the next test: Huang Lee was going to transfer into a chimpanzee.

The technicians kept them both in cages and strapped into chairs. They didn't know what might happen to either of them, or how much intelligence would make the transfer and how much would stay behind. That was what everyone wanted to find out.

So when the lights dimmed and the machines did their zap thing, it took a few seconds to tell that there'd been any change. Then the chimp body flexed a little, groaned, and a slurred voice said, "Wow. Ish ish shtrange."

"Huang?" Margaret asked. She was standing right beside his cage, with Arthur, Candi, and some of the other techs beside her.

"Yesh." He strained against the straps, then said, "I shink you can ret me go."

"Do it," she said to the technician in the cage with him. While he did that she looked over at Huang's body. "Dina?" she asked. They'd used a female chimp because she was the friendliest of the lot, and they'd already had experience with gender switching so they didn't think it would matter much for their first nonhuman study. The species differences should completely overwhelm the gender differences as far as uniqueness of the experience went.

Dina nodded. She *nodded!* Margaret almost dropped her notepad. Dina's mouth worked for a moment, then she said, "Ah, ah, ah." She tugged against the straps just as Huang had done, but when she realized she was held down she just settled back into the chair and looked around the lab.

"You're going to be all right," Margaret assured her. "This is just for a little while."

Dina looked at her with an expression that said clear as words, *Yeah, right.*

"I mean it," Margaret told her. "This is just a short test." She wondered how much of that the chimp understood. Dina just blinked at her, so she turned back to Huang and said, "How do you feel?"

"All ri'," he said. "But shoo, thish plash shtinksh!" He stood, stretched his arms and legs, and twisted around. "Man, I feel like a gymnasht. This body'sh limber."

"How's your mental capacity? What's nine times six?"

"Fifty-four," he answered immediately.

"Fourteen squared?"

"Ahh . . . a hundred and . . . ninety . . . four? No, ninety-shix."

"What's the windspeed velocity of an unladen swallow?"

"African or European?"

The technicians all looked puzzled even before Huang and Margaret burst into laughter. She hadn't expected them to get a Monty Python reference, but she knew Huang would—provided the part of him that had watched *The Holy Grail* with her the

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previous night had made the transfer.

Huang's laughter turned into a series of shrieks like Dina made when she was upset. Huang jumped up and down a time or two as well, then he suddenly stopped and said, "Shorry. Got carried away there. There'sh a *lot* of inshtinctive behavior to fight off."

"Like what?" Margaret asked.

"Like . . . I want to throw shit at everything. The real shtuff. I'm pished off just looking at all of you out there on the other shide of the cage. I want room enough to run and climb in, and no people around."

Margaret nodded. "That's pretty much what a freshly captured chimp feels, I'm sure." But Dina had been raised in captivity. If she still felt that way they had a serious ethical dilemma on their hands, but how could they find out how much of her body's attitude she carried in her mind? That was the important question.

Or was it? Arthur and Candi had proved that the body and the mind worked together to create the whole person. If Dina's body hated captivity, wasn't that reason enough to let her go free?

Margaret looked back at her, shoehorned into Huang's body and strapped to a chair inside a cage, and she suddenly felt ashamed. "Let her go," she said. When the technician at her side hesitated, she said, "We can't learn anything with her immobilized like that. She's calm enough; let her go."

So they did. And when the last strap came off, Dina rose to her feet, stepped over to the edge of the cage farthest from everyone, lifted her hospital gown, and peed. Standing up.

The first test ended after an hour, but when Huang reported no long-term complications and Dina seemed to settle right back down, they swapped again for longer and longer periods. Margaret had hoped Dina would eventually learn to talk, but aside from learning the names of a few objects she never did pick up the language. Huang tried to describe what it was like in a chimpanzee body, but aside from "furry" and "itchy" and a few other adjectives, no one really understood what he was getting at. They realized pretty quickly that you had to be there yourself to fully comprehend it.

The transfer process worked so smoothly that they tried it on other animals, just to see what would happen. Arthur swapped with a dog—a Saint Bernard puppy—and he said afterward that it had been one of the happiest times in his life. He hadn't gotten many of the test questions right, and he'd eventually gotten bored with the whole proceedings and had lain down to chew on a rawhide stick, but when he transferred back into his own body he said that was mostly because he didn't care what Margaret wanted. He was too content with being a puppy.

They couldn't say for sure how the dog felt about the experience, because it had spent most of its time in Arthur's body trying to stand up. Arthur said his legs still felt wobbly for hours after he switched back.

And all the while, Margaret wondered: What's it really like? What sub-

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tle differences aren't the corponauts, as they'd come to call themselves, reporting? How much of what they did report was she misinterpreting?

And how much of the child like delight they exhibited was endemic to the process?

She got her chance at it with a cat. She wasn't the first—by then the real explorers had worked their way down to mice and lizards and even a cockroach, which according to Candi had turned out to be incredibly pleasant once she got over the idea of what she'd become. Her intellect had felt compressed, she said. Altered to fit the smaller brain, but she couldn't describe it better than that, nor explain why it hadn't bothered her. At that, Margaret told Dr. Hayward that she needed a transfer experience of her own if she was ever going to understand what it was like for anyone else, and when he agreed to let her, Candi suggested a cat.

By then they were getting pretty cavalier about the whole proceedings; just strap down, slap the helmets on, and hit the switch. One minute Margaret was looking at the lab's resident mouser, a yellow-and-white striped domestic shorthair named Isabelle, and the next minute she *was* the domestic shorthair, only she didn't feel domestic. She felt wild and sleek and sensual, even in the zippered bag Isabelle had been confined in. Only her head stuck out, but that's all she needed at first. She looked over at her human body and saw a mountainous bulk of flesh, already slumping in the chair as the anesthetic hit. The technicians had decided to knock out the human bodies during transfer to avoid panic when the lower animals found themselves in an unfamiliar body.

"I'm all right," she tried to say, but the cat's mouth and tongue didn't cooperate and instead of words she got a warbling gurgle that sounded like a tomcat on the prowl. So she blinked her left eye three times, the code for the same thing, and waited for the technicians to let her out of the body bag.

Stretching was divine. She licked a couple of itches, shivering at the feel of sandpaper tongue through smooth fur, then padded across the floor toward Candi, who was taking notes for her. Just walking in that body felt better than anything she had done in years.

"How are you doing?" Candi asked. Her voice boomed.

Margaret tried a meow in response. One for "yes" or "good," two for "no" or "bad." They didn't have a code for "fantastic."

Candi laid the child's keyboard they used for animal tests on the floor in front of her and asked, "What's seven times nine?"

Margaret knew the answer, but it made absolutely no difference to her whether or not she told anyone. Candi's leg looked warm and inviting, so she leaned up against it, rubbing her cheeks and sides as she arched past.

And then she felt the purr start. Chocolate with orange peel didn't compare. Nor did winning a lottery. She had once had a multiple orgasm; not even that was as good as purring.

When Candi reached down and scratched her between the ears, she

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knew that humans had been shortchanged.

She managed to stay in Isabelle's body for almost three hours, mostly by sucking up to everybody in the lab and begging for more time. The sight of Margaret, aged matron of the psych department, slinking about and jumping into laps like an exotic dancer, was such a shock that nobody knew what to do. But Candi finally picked her up like a limp dishrag and carried her back to the transfer machinery.

"You've got to go back," she said. "It's time to go home."

I am home! Margaret wanted to tell her, but she couldn't get the concept across with Isabelle's vocal equipment. Besides, she knew what she meant: it was quitting time, there was a weekend coming up, and she was keeping everyone in the lab. So she let Candi stuff her unceremoniously into the body bag, strap the helmet onto her head, and throw the switch.

A lid came down over the world, a blanket of fog and fuzz and muffling cotton. Some of it lifted when the tech neutralized the anesthetic in her system, but she knew that was all she could look forward to.

"Are you all right?" Candi asked, picking up her hand. The touch sent the memory of an electric thrill coursing through her, just the palest ghost of what she'd felt as Isabelle.

"I—as right as I'll ever be," she said, knowing Candi would never understand what she meant by that. She took a deep breath. "Wow. That was amazing."

Candi smiled. "You looked like you were enjoying it."

"You'll never know," Margaret told her.

"No, I suppose— Sure I could. That's the whole point of this."

Margaret shook her head sadly. "I'm afraid you'd have to spend at least a decade being me first, to understand the contrast."

"Ah." Candi looked at her again, frowning. "Are you sure you're going to be all right?"

"Fine," Margaret told her. She didn't know whether that was true or not, but there was nothing Candi could do for her even if it wasn't. Even swapping bodies wouldn't have cheered her up. After Isabelle, being merely a young California blonde would have been an anticlimax. And besides, any human form would bring with it human feelings and human problems. The other corponauts' experiences proved that the capacity to feel joy existed in every test subject, no matter how primitive, and a simpler animal made for a more pure experience.

She helped put away the equipment and let Isabelle out of the bag. The cat seemed little worse for her experience; she had probably felt a little disorientation, then had fallen asleep. She might have had some odd dreams, but those probably wouldn't have registered after she woke up any more than Margaret's normally did. Margaret reached down to scratch her between the ears, and grew warm as the cat started to purr. She remembered how that felt from the inside.

Isabelle followed her to her office and jumped up on the window sill,

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looking for birds, but there was no motion in the tree. Even the caterpillar Margaret had watched spin its cocoon was no longer visible. The fuzzy oblong shelter that hung from the underside of a leaf hid the miracle of transformation going on inside.

That's what I need, she thought. A complete makeover. Rebirth into a younger, more sensuous body. One capable of *feeling* something again.

She sat down at her desk and leafed through her files. Notes for a paper on gender-specific behavior patterns, recommendations for using the Tilbey Transfer process in psychoanalysis, speculation on why intelligence and "quality of life" seemed to be inversely proportional—as if either quantity could be measured objectively. Even so, she could get a dozen papers out of the data, gain notoriety, maybe even win awards.

Oh joy.

It was nearly dark when she returned to the window, reached out, and snapped off the branch.

Fitting the electrodes onto a cocoon was easier than attaching them to a moving, struggling insect. Margaret was glad of that; she didn't have the experience the technicians had. Putting the helmet on herself proved hardest, and pulling the chair around so she could reach the switch. But she eventually got it.

She hesitated with her hand on the switch. Sweat beaded her forehead, and not just from the exertion. She didn't know how long it would take for the metamorphosis to occur, nor how long a butterfly lived once it emerged from the cocoon, nor how her body would handle a weekend in a couch with a caterpillar in control. The caterpillar might actually do OK; it was ready for a transition, after all.

So was she. She would try to return if she could, but some part of her that she was afraid to examine too closely didn't really care if she made it back. Not after Isabelle.

She had considered shouldering aside the cat again, this time permanently, but she couldn't subject such a free and happy creature to the trade. Besides, she was an aging, frumpy, depressed woman who knew she ought to seek professional help, but she was still a scientist, and there was another world waiting to be explored.

She threw the switch.

Inside the cocoon, a spark of consciousness blossomed. Margaret was self-aware only in the way that the universe is self-aware through its creations. At the moment she *was* the universe.

But as time passed she began to understand that there was a boundary, and she felt an undeniable urge to push beyond it. She struggled, became aware of unfamiliar limbs, and learned to control them until she could tear away the threads that held her prisoner. Emergence brought blessed relief; unfurling the wide, flat wings brought joy.

Vision took a moment to comprehend. It was segmented, gridlike. Different than . . . than what? Than not seeing, apparently.

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Cold, sterile machinery, dappled with blinking lights and festooned with wires, stood all around. A mound of pale flesh, incomprehensibly large and ponderous, lolled in a chair nearby. But across the laboratory, beyond the open window, evening sunlight bathed the trees and flowers with its warm, beckoning light, and the scent of nectar and pollen tugged at her as well.

Margaret fanned her wings until they dried completely, then she flapped them harder and lifted into the air. She didn't need to think about how to do it; instinct guided her motions.

Her wings were works of art. The world around her was an endless sea of delights. The rapture she felt as she fluttered through the air into it all was indescribable.

Fortunately, she didn't have to try. ■

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Stephen L. Burns

ROLL OVER VIVALDI

Music hath charms, all right—but charm is in the ear of the beholder!

Illustration by Dell Harris

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The concert was going badly. The audience was getting ugly. And I mean *ugly*. They were completely and indelibly redefining the word and concept in a way I hope to never see matched again.

This was about three years ago, when Triaxion was playing on a planet named Sk'rrl. The average adult sk'rrli is about two and a half meters tall, and looks like an unhappy cross between a cooked lobster and an anorexic grizzly bear. Now take several hundred of these hulking creatures and whip them into a sort of lynch mob/soccer riot/piranha smorgasbord mood. Face *that* with an instrument in your hand and you begin to get the sinking feeling that any encores you might perform are going to be on harp, with heavenly choir for backup.

Being sensible folks, Maire, Rube and I—a string trio who performed under the name Triaxion—were scared spitless.

The only positive aspect of our situation was that dumb embasstard we called Dork was even more terrified than we were. If we were crapping bricks, he was on the verge of filling his pants with entire buildings. He had good reason. The sk'rrli who had him in their pincered paws seemed inclined to tear him limb from limb, eat him alive, or both.

It was definitely the low point of our concert.

"You *must* be joking."

Those were the ambassador's first words as he stared across his desk at us. Not *Hi, how was your trip?* (after all, we had traveled two hundred and some odd light-years to get there) or even an insincere, but at least minimally polite *Welcome to Sk'rrl.* The expression on his long face matched this disdainful greeting. He had a lemon-sucker's mouth, a gin-drinker's breath, gimlet eyes, and the nostrils of his piccolo nose were flared as if smelling something bad. Nice hair though, a flowing silver mane that looked almost manufactured.

Maire, Rube and I exchanged a covert glance. Maire rolled her eyes. Rube grinned and turned to face Ambassador Dorchester Hepplewhyte, who in that moment forever became *Dork* in my mind.

"Three musicians meet at a bar after work," Rube intoned as if imparting critical wisdom. "A violinist, a flautist, and a pianist. The violinist puts down a five and orders a beer. The flautist does the same. The pianist hauls out a big wad of bills, peels off a hundred, slaps it down and says, 'Give me the best wine this dive has to offer.' The other two musicians stare at him a moment, then drag him off his stool and beat the living hell out of him."

Dork stared at Rube, face squinched with a mixture of bafflement and pique. "What the devil are you talking about?" he demanded.

Rube's grin took on a crazy edge. "Pianist envy."

Maire and I couldn't help snickering, both at the old joke and the look that appeared on Dork's face. He looked like a man who had just bit into something crunchy at the very moment he was noticing half a cockroach in his caviar. I knew that we had just dropped another dozen strata in his

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estimation. I should have cared more than I did, but I ask you, how much weight can you really give the opinion of someone with a name like Dork?

Like space itself, the system essentially sucks. Every bureaucracy by its very nature creates a vacuum into which are drawn megamounts of malingering, monotony, monomania, malfeasance, misguided machinations, and just plain muddle. The ETDS (the Extra Terrestrial Diplomatic Service) is a mind-numbingly humongous bureaucracy; the sort of human enterprise which could become truly dangerous if it ever managed to run at more than 5 percent efficiency.

Dork's expectations had been clearly and abysmally failed by our arrival. Had been failed by the three of us. What he had done was requisition a cadre of classical musicians from the ETDS's Cultural Assets Branch, and it was obvious that he'd thought he would get a small orchestra, or at the very minimum an octet. Now he could only conclude that his mission didn't rate as high as he thought, because all he'd gotten was a lousy trio.

He could probably have swallowed that slight—diplomats snack on slights the way other folks munch salted peanuts—except that in a certain kind of mind the concept of a classical ensemble raised certain clichéd expectations. Dork obviously had that sort of mind, and we'd missed his mental mark by even further than we'd traveled to get there. Of course it was a rather small target.

It would have been easy to adopt a *screw him* attitude. Actually, just meeting him made it nearly impossible not to. But like it or not, we did have to get along with him. Although all three of us were world-class musicians and products of the finest conservatories, we were basically conscripts and our future partly hung on his performance report. The only way to stop being part of the Cultural Big Stick the ETDS kept whacking poor defenseless alien races with was to gain enough plus points for a discharge. He had points to give, and reeked parsimony.

As leader of our admittedly motley troupe it was my job to make nice, mend fences, smooth ruffled feathers and kiss up. I forced a smile.

"Rupert is quite a kidder," I said in a placating tone, "and the warpout drugs tend to make him giddy." I offered my hand. "I'm Schlomo Kessel, first violinna and leader of Triaxion."

Dropping my name made him blink in surprise. It even retuned his estimation upward a bit from b-flat. He leaned forward to give my hand a limp, damp squeeze, trying to hide a frisson of fazement. I have a certain fame—and infamy. I think he was almost impressed enough to write off my faded aloha shirt, patched jeans, and crusty sandals as personal eccentricity.

I went on to introduce my fellow musicians, preferring to jump over my own checkered past. "This lovely lady is Maire MacAuff Matsumi, violinna and viola la bamba. She has, among other honors, played first violin and violinna with the Glasgow, Dublin, London, and Tokyo Philharmonics." Maire curtseyed and coyly batted her eyelashes at Dork. Their having been threed into

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tiny writhing snakes put a bit of hurt in her flirt, but they went with her ragged black cryptozoid weeds and white marbleized buzzcut. Dork managed a queasy smile in return.

Next I indicated Rube, his chubby body resplendent in a glittering hololame jacket, mustard paisley biballs and fluorescent puce Shooz. "Our third member is of course the famous soloist Rupert Czaro, cellotta and occasional stand-up comedy."

"Let us hope the occasion is over," Dork sniffed haughtily, gesturing that we should sit. We got three wobbly straightback buttnumbers facing him. He settled back into the chair behind his desk, a padded monster only a few jewels and a bit of gilding shy of being a throne.

"I'm sure it is," I answered, shooting Rube a warning glance. He tried to look innocent with no particular success.

"Good." Dork sighed, clasping his manicured hands before him. "My life is quite difficult enough as it is on this madhouse of a planet. *Unspoiled,* they said when they assigned me here." His dour mouth twisted. "Savage would have been a better description. Beastly. Why, the natives here are so uncouth they won't even let us have walls!" He refilled a glass from the silver pitcher at his elbow, downed half of it. A flush suffused his face and the sharp scent of gin wafted over us.

"I'd kind of wondered about that," I admitted. The embassy had a roof and floor, but not a single interior or exterior wall. The various rooms inside it had been marked off by lines painted on the floor. The staffer who had escorted us from the pad had ignored the lines until she got close to the Dork Zone at the building's center.

"They found the very idea of walls insulting. They are exceedingly, ah, up-front about everything in what passes for their society. They have sex in public and quite loudly. They bathe by licking each other. As for bathrooms. . . ." He shuddered, a pinched and haunted look misting his eyes.

"Sounds like you've had a hard time here," I said commiseratingly. A little sucking up never hurts.

"You don't know the half of it." He let out a put upon, self-pitying sigh. "Still, this is where I was assigned, and I have to stay in this foul bedlam until my mission is considered a success. My mandate is, of course, to broker a trade treaty."

"Of course," I agreed in a man-of-the-world tone. Trade as in *You get these nice shiny beads, and in exchange we'll merely glom vast amounts of whatever it is you have that we want.* While the ETDS is constrained by a complex set of regulations governing such transactions, few alien races have proved a match for the species who spawned EZ Payment Plans, pyramid schemes, home shopping, plagueads, service contracts, and insurance.

"But I have not been able to strike any sort of deal with these monstrous creatures." Another consoling slug from his glass.

Maire looked up from threeding her nails cryptozoid style, making it look like weevils and centipedes were chewing their way out from her cuticles. "What is it they have we want?"

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she asked. When Dork looked her way and saw her handiwork he went a bud green around the gills.

"Mrr'hhg."

"Excuse me?" I asked, thinking it might have been a gastrointestinal reaction to her artwork.

"Mrr'hhg. They're the fuzzy, crablike creatures the sk'rrli eat. Ugly little monsters, really, and quite prone to biting. The Embassy would be crawling with the damned things, except we found that they don't like the smell of disinfectant." That explained why the open-air structure smelled like a public toilet.

"The sk'rrli eat the mrr'hhg, and the mrr'hhg eat, among other things, the sk'rrli's, ah, wastes. This disgusting habit is the reason the sk'rrli are totally immune to disease. The ETDS want the vile scuttling things because they secrete a substance which I'm told is a nearly universal antibiotic."

I knew it had to be something. It wasn't like the ETDS contacted and embassified other races out of altruism. "I assume that 'scientific samples' were collected and sent to the labs on the initial covert survey." The ETDS usually went the Trade Mission route only after filching failed.

He scowled and nodded. "That's why I was sent. The antibiotic can't be replicated or synthesized, and the mrr'hhg they took all died. They can't survive without the stuff, um, produced by the sk'rrli."

"Who don't want to share their lunch with their new friends." I glanced at my troupe. Maire was probably finding this stuff fascinating, though you'd never be able to tell by looking at her. Rube had begun squirming around restlessly, showing the classic signs of the onset of the urge to play "Torment the ambassador." I figured I'd better wrap this up.

"I'm sure you will be able to work something out, sir," I continued, trying hard to sound like I cared. "So why have you brought us here? Morale raiser for the staff?" From what we'd seen they needed one.

"Hardly." That word and the sniff he let out told me everything I needed to know about his concerns for staff morale, and why it was so low. "As I said, the sk'rrli are quite barbaric. They're a brutish lot, highly excitable, absolutely impossible to bargain with, and completely bereft of any cultural achievements one would recognize as such." He made a dismissive gesture. "Oh, they do have a rude sort of music. Dreadful stuff, even worse than the crudest gutter-class thumping and howling one would hear on Earth. Still, one must start somewhere, and I had the thought that exposure to something finer than their raucous noise would give them a civilized ideal they might emulate."

I had heard that sort of überkultural *teach the wogs opera* sort of thinking before. It's more or less SOT (Standard Operating Thinking) in a disheartening percentage of the ETDS. Giving the natives a chance to experience our music is fine. Thumping them over the heads with it is an insult to both the audience and the music. We do what we can to soften the blow.

"OK," I said, "We get the picture. When, where, and what do you want us to play?"

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Dork brightened at my no-nonsense attitude. He'd probably been expecting arty arguments against cultural imperialism. The thing is, we love music in general and our chosen repertoire even more. We think it's valid, valuable, and worthy of dissemination. We would present it for the audience to either like, or find not to their taste. You can't know when art will leap the gulf between cultures and worlds. When by chance you do connect, it's a rush better than any drug. I know, I've tried them all.

"We will set you up using one side of the Embassy itself as a stage. Can you be ready to perform tomorrow night?"

"We could play tonight if you wanted." And be gone tomorrow, hopefully with some plus points notched in our instrument cases.

He shook his head. "No, tomorrow night. This must be staged most carefully for proper effect. I want these creatures *awed*."

I shrugged. "It's your party. All we need are three chairs and a platform to hold them, us, and our music stands."

He nodded, that lemon-sucker's twist coming back to his mouth as he gave us each a critical eyeballing. "I do hope you have proper attire."

I held back a sigh. "Orchestra drag? Cutaway jackets, boiled shirts, cummerbunds and black shoes?"

"And pants," he added, glaring at us like he thought we were the type who wouldn't wear any unless ordered to.

"And pants," I promised, making it sound like a major concession. "Now did you have any particular programme in mind?"

He rubbed his soft hands together in delight, eager to demonstrate the depths of his taste. "Oh yes. I want music that is sweet and soothing, light and uplifting. So I want you to play—"

"The Four Seasons," I finished for him.

He looked startled, then beamed in delight that I was so simpatico. "That's it exactly! You must have read my mind!"

What there was of it. I swallowed another sigh. Sometimes a musician in my line of work has to swallow sighs the way a diplomat swallows slights. This guy was giving me a surfeit of sighs. "Anything else? Something a bit more challenging? Do you know Saint Saëns's *Danse Macabre*? How about some Sibelius? Some Copland? Bach or Bartok? Or—"

"No no no," he chided. "I want to soothe these savage beasts. Seduce them with one of Earth's finer things."

Or bonk them with chestnuts. Now don't get me wrong, the Vivaldi is a *wonderful* piece of music, a masterpiece. But nine times out of ten the diplomats who requisition us know only three pure classical pieces by name, and *The Four Seasons* is two of them so it's requested ten to one over anything else. Not that any of them could whistle it. Its name is recognizable, easily memorizable, and it doesn't have any slippery opus numbers to remember or mispronouncable German or Italian or Russian names to mangle and thereby make them look like a nulkulturny boob. But the manglers are at least trying to reach a little more

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deeply into the repertoire; I will always fondly remember the poor guy who wanted us to play *Whiner Miner Nacho Music*.

The third piece? *The Blue Danube* waltzes away with that honor, of course.

You have to bear in mind that your average ETDS ambassador is basically a pirate who has gone to the Right Schools, knows a few People Who Matter, and flies a lace-trimmed *Jolly Roger*. Their one act of imagination—thinking that life as an envoy would be easy, glamorous, and make them rich—is long behind them. Their concepts of culture and style and good taste are a caviar-crusted, champagne-soaked hash of cliché served on a tarnished silver salver.

"We'll soothe them into catatonia," I promised, signaling to my cohorts that it was time to get out of there. We stood up and started to leave.

"What do you think you're *doing?"* he honked shrilly before we'd gone a dozen steps.

We stopped and looked back. In the instant our backs had been turned his glass had been magically refilled. "Going to practice," I explained.

He pointed at our feet with a shaking finger. "Would you be so kind as to leave by the *door?"*

We looked down. Sure enough, we'd gone straight through one of the walls. Well, we were escaping.

"Sorry," I said. We recrossed the invisible wall and this time departed through the non-existent door.

"And don't slam it after you," Rube whispered as we went over the theoretical threshold.

* * *

We hadn't gotten much of a look at our prospective audience on the way in from the shuttle to the Embassy, and that situation didn't change much as a staffer escorted us back. All we saw was some indistinct activity off in the distance, like big red ants walking upright. Because of the sk'rrli Wall Ban there was no fence around the Embassy. The distance the natives kept suggested that they found something offensive about the place. Maybe it was the *Eau de Disinfectantte*. My money was on it being Dork.

Once we were seated in our shuttle it lifted off and headed back toward where our ship was parked on a high, all but airless plateau some 500 kilometers away—skipships are never left where the natives can get their hands, claws or tentacles on them.

"We're not going to practice the Vivaldi, are we, Mo?" Maire asked hopefully.

I just smiled.

Rube squinted at me. "You know that we know it by heart. Hell, I bet someone could cut our heads off, hand us our instruments, and we could *still* play it note-perfect."

I remained silent, but let my smile grow a bit wider.

Maire grinned and clapped her hands. "It's Name Time!"

"Screw," I began.

"Screw who?" Rube breathed.

"Screw Dork."

"Dork!" Maire hooted. "Perfect!"

Rube bowed. "You, sir, remain the master."

This was one of our many little san-

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ity-preserving rituals. As senior member I held the baton, leading Triaxion. One of the self-imposed demands of my high office was coming up with a nickname for whatever clown had requisitioned us like were some piece of equipment: Musical Ensemble/Trio/String/Classical.

"And as for practicing the Vivaldi . . . " I continued, pausing for maximum effect. Both were nodding and grinning, waiting for the word.

"Well, I think I'd rather see us die."

They applauded. I took my bow, accepting their accolade.

Rube had been part of the trio for nearly a year at that point. Maire had come on board some four months before him. I've been doing this longer than I care to remember, and had held the baton for nearly eight years by the time we played Sk'rrl.

We spent weeks at a time cooped up in our ship, getting from one gig to the next. Superluminal travel takes next to no time at all compared to rockets and stuff like that, but it still takes just over two hours to sneak edgewise around a single light-year—which meant our 200+ ly trip from Driffel IV to Sk'rrl took just shy of three weeks.

That's ample time to turn even the mildest-mannered musician into a slavering homicidal maniac. Diversion was of supreme importance, especially since sex was out—both Rube and I were purehet and Maire absolez. Over the years I've assembled various social mechanisms to help avoid bloodshed.

We each had our own extensive entertainment libraries. Most nights one of us would take on the mantle of EJ, programming group viewing and listening. We also took turns choosing the evening meals, and followed an arcane, complicated system of trading food and menu control privileges for small favors, game partner duty and the EJ anchorship.

And of course we practiced, practiced, practiced every day, even though each of us had indeed played Carnegie Hall. This was done both solo and as a group. To spice that up I had come up with the die.

When we got back to our ship and reached our practice space I removed the dodecahedral superbounce rubber die from the ornately carved hikkawood case we'd gotten for it on Klaaaam. Each of our names was inscribed on four faces on the die. Whoever's name came up got the baton for that session and picked the material we would practice.

My taste ran to idiosyncratic arrangements of Bach, Mozart and Grieg, mid-20th Jazz from Ellington, Basie and Charles, and have an unending fascination with early 21st South African composer Jaan Biko's "Uhuru" movement concertos. Maire went in for madrigals, Baroque, traditional Celtic, Middle Eastern funeral music, and Classic Pop of the late 20th. Rube's choices were too wildly eclectic to be pigeonholed, though he'd made his concert mark with highly acclaimed interpretations of Bartok, Liszt, Rostropovich, Shostakovich, and Elvis Havel.

I tossed the die. It bounced erratically around, finally coming to rest at

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Maire's feet. She bent down to read the verdict. "I guess you're it, Rube." she announced.

He grinned like an evil cherub. "Excellent choice, Lady Luck. Shall we?"

We took our seats and turned on our music stands. I touched the stud that turned the baton over to him, making his stand the master and ours slaves. Both Maire's and my displays blanked while he made his selection. Every music student at some time plays "Stump the Stand," a game that's all but unwinnable. A Frewer Concert Grand music stand has well over 71 million pieces of music stored in its memory, and back in the home system updates are automatically done weekly. So the score to everything from the latest Aleutopop chant to the most obscure medieval madrigal like *The Wart on Friar Frederick's Fanny* is there for the asking. With all that at his fingertips, Rube could present us with literally anything.

When my display cleared it showed the opening measures of *Robot Spider Tarantella* by Lunar composer Faisal Frick, a half-hour long virtuoso piece bursting at the seams with high-speed arpeggios and minor key contrapuntal runs. Frick was quite often called "Cyberbach" because of the extraordinarily complex mathematical structure of his work.

"This ought to be fun," I said, picking up my violinna, powering it up and hitting autotune. Maire did the same. Rube got his cellotta in position, took a couple of sword-slashes with his bow, then regarded us with a raised eyebrow. "Are we ready?"

In the arrangement he'd chosen I had the opening notes. I answered by striking them, and away we went into that magical place where we breathe life into music, and it breathes life into us in return.

Like I said before, we were all basically conscripts. But don't let that fool you; each of us was accomplished enough to play with the finest orchestras, and had. It was just that a combination of bad luck and certain personal disasters had put us in the contractual clutches of the ETDS. Maire had been trying to put a failed love affair behind her, wanted to see really far-off places, and so one dark night of the soul in Dubuque she'd enlisted. Rube had hanky-pankied himself into a situation where getting outsystem and thereby beyond the reach of a certain cuckolded and Colt-carrying cellisticidal Czech conductor had been prudent.

Each of us had considerable experience in performing both pure Classical and Pops repertoire, and could play literally anything on first sight. We put in a lot of practice time, and as a working trio played like we were telepathically linked. You name it and we could play the hell out of it.

As we practiced we had absolutely no idea that the very next evening we'd be giving the performance of our lives. Because we'd be playing for our lives.

Not knowing stuff like that is good, I guess. Makes getting out of bed in the morning a bit easier.

After breakfast on concert day Rube and Maire took the shuttle back to the

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enclave. Maire wanted to do some sightseeing and a bit of amateur exoanthropology—pursuits a bit at odds with the persona she cultivates. Rube's sole interest outside music is sex, and it was a given that his plan was to find some female staffer who would be susceptible to his pudgy Gypsy charms.

Maire always said we were fools for not making the most of our time spent on these alien planets by experiencing and learning all we could. She was probably right. Rube always said I was a moron for not trying to make some whoopee while there were some potential whoopee-makers to be made. A little of his brand of exploration would no doubt have done me some good as well. Yet with both these options open to me, I always chose to stay behind and revel in having the whole ship to myself.

I got on extremely well with both of them and their predecessors, but I also enjoyed and truly needed solitude. This is largely because of who I am and what I used to be.

Yes, I'm *that* Schlomo Kessel, the child prodigy who was playing Mozart on the violinna by age four, and composing full concertos by age six. By age ten I had already been guest soloist with several of the major Philharmonics for the performance of the two symphonies I had written by then.

Classical music goes through periodic cycles of being in vogue, and then being regarded as yawno stuff strictly for fogeys and firps. I had the luck, for good or ill, to come along during a period when it was considered absovac, and I became one of its hottest stars. From the very first my family recognized my talent and treated me like a marketable commodity with a limited shelf-life. My childhood couldn't have been stranger if I'd been raised by pimps and hammerhead sharks; I was money and meat to them. By age fourteen I was an erratic, overextended, substance-sucking burnout, and by seventeen a hopeless basket case—all this under the unblinking scrutiny of media insatiable for scandal and milking my meteoric rise and ignominious implosion for all it was worth.

Not long after my twenty-first birthday a music-loving guard at the Alabama county prison where I was residing, thanks to vagrancy and public subtoxication charges, recognized me as *that* Mo Kessel. Bubba X's attempts to get me some help caught the attention of the ETDS, who are always on the lookout for beleaguered talent to dragoon. They bailed me out and had me detoxxed, a process not unlike wringing out a towel used to mop the floor after an earthquake at a pharmacy. Once I was semi-coherent one of their lawyers walked me through a proper bankruptcy (as opposed to the kind I had managed on my own), then explained that by availing myself of their services I had enlisted for a three-year minimum hitch.

I was thirty-five when we played Sk'rrl. You do the math.

My happiest, most contented moments outside of playing music come from being totally alone in a place hundreds or even thousands of light-years from the media, from my former fame, and from a family that would no

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doubt do their damnedest to turn me back into their meal ticket if I ever returned.

Rube and Maire returned late that afternoon. Rube wore his smug and goofy *I got lucky!* grin and headed straight to his compartment for a post-coital nap. Apparently the lack of privacy hadn't put him off. I'm not sure what would.

Maire and I settled into the galley for some tea and cookies, another of our little rituals. She always felt it was her duty to report on her explorations so I'd have some vague idea as to where we were. We always made a minor event of it by having a debriefing tea.

This time there was a serious, pensive air about her that made me vaguely uneasy. I poured and asked her if the place was as bad as Dork had said.

"No," she replied after a moment's frowning thought. "Dork said the sk'rli are savage, but they're not. Not the way he meant it, anyway. Just very primitive, and totally without artifice."

"How so?" I asked. Maire's voice is lovely, a warm smoky alto totally at odds with the zombie cryptozoid image she cultivates. I admit I had a secret desire to have her whisper sultry suggestions in my ear in the dark, but knew that wasn't going to happen unless I got a genbed.

"They're like their music—which is actually quite interesting. Very direct. Simple emphatic statements with no subtext. Music made to provoke a direct response, not subtly invoke a mood or image. Think late 20th Rap or various aboriginal war chants. I recorded some if you want to hear it later."

"Sure." I scratched my chin. "Are they as, well, less than pretty as they looked from a distance?"

That made her laugh. "Oh yeah. The embassy staff call them *lobbears*, and it fits. The adults are huge, with patches of ratty red fur over shiny red chitin. Body shaped like and almost as heavy as a bear's, thick arms and legs with exposed joints. Big paws, with these nasty looking pincers instead of claws. Lobster eyes and feelers, bearish muzzle, lots of teeth."

I suppressed a shudder. "Well, I suppose their children are cute."

She grinned and shook her head. "No, not really."

"What kind of audience do you think they'll make?"

Her grin faded and she toyed with the handle of her teacup. "I'm not sure. They do like music, and make quite a lot of it. But I'm not so sure what Dork wants us to play is the sort of thing they will appreciate."

I shrugged. "Well, what's the worst that can happen if we bomb? They'll just boo—or whatever it is they do."

"Maybe . . ." she replied, stretching the word out.

"What?" The look on her face was not encouraging.

"These people don't hide their feelings, Mo. They respond to things forcefully and directly. I saw a child take a mrr'hhg away from another child. It's mother didn't say *No no no* or slap its paw. She just grabbed the kid's hand and tore a couple of pincers off it."

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I nearly spilled my tea. "She what?"

"I know. Edwina—the staffer I met who acted as my guide—explained that the pincers will grow back, and to the sk'rrli mind the new ones will be less likely to latch on to others' things. Like I said before, these folks are unswervingly direct. If a male and female get the hots for each other they have sex right then and there, and make as much noise as they can to let everyone else know how good it is. If they get mad at each other they fight it out. If one wants another's nest mound, he or she goes right over and says so. Either a trade is struck, the mound-hunter accepts no for an answer, or they tussle for it. They're a little, um, prone to violence."

I had to ask. "What do you think they might do if they don't like what we play?"

She met my gaze squarely, solemnly. "It could get ugly."

Her words made me shiver then and now. Maybe it was some broguey whisper of her partially Celtic bloodlines which gave her the gift of prophecy.

We talked a little about being on our toes during the concert, then went to our respective compartments to rest up for it. Since we all grabbed a quick bite to eat while we dressed, I didn't get a chance to talk to Rube until the shuttle ride to the enclave. I tried to make him understand what we might be facing, but didn't get far. He was too buoyantly positive that seeing him perform on stage would drive the woman he'd found that afternoon into a frenzied hunger for an encore, and wasn't thinking with any part of his anatomy above his cummerbund.

We arrived just after sunset, landing on the pad behind the Embassy. The wide boggy plain surrounding the place was lit with torches and cooking fires. The air was filled with the surprisingly mouthwatering smell of roasting mrr'hhg.

Maire informed us that they only cooked the things on high occasions.

Like wars. Or funerals.

The great man himself met us at the pad, puffing gin fumes and exuding his usual anticharm. In most cases the person in charge of these sorts of affairs tends toward one of two states: either they are in a fractal dither, worry sprouting from anxiety unfolding from borderline panic; or they have this smug and lofty conviction that their plans are perfect, the wogs will be wowed, and the universe will bend itself to their will. Dork was in some sour, semi-pickled state between.

He looked us up and down, pronounced our dress acceptable, then strode self-importantly off with a curt gesture that we should follow. We heaved a collective sigh, picked up our cases and fell into step behind. He led us through the maze painted on the embassy floor, snapping conflicting orders at his scurrying staff like an imperious impresario, and leaving puzzled looks, rolling eyes, and an impressive catalog of obscene gestures in his wake.

The two-meter-high stage had been set up on the opposite side of the embassy. Because of the sk'rrli prejudice

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against walls there was no backdrop behind it nor curtain in front.

Still, I do have to give Dork credit for trying to make the best of difficult circumstances. If nothing else, he had produced an event the likes of which the natives had surely never seen. Colored spots flooded the stage with pastel light. The front of the platform had been draped with banners in the official ETDS orange and black, and bedecked with sconces of native flowers. Most Sk'rrl plants are insectivores, so the bouquets writhed and snapped at bugs drawn by the light. Maire was enchanted with this odd snatch of the decorator's art. I could tell she dearly wanted a corsage. Atop the stage and past the footlights were three hard chairs for us and the ornate throne from Dork's office for him.

Normally an embassy soirée would have featured champagne—getting the visitors hammered considered a fair home team-advantage. None was being served to the guests at this bash, but a clever steward had found out that the sk'rrli did like Yummi-Ade—you know, that neon colored, sticky sweet instant drink—and even caught a modest buzz from the artificial colors and flavors. So a punch fountain had been set up, squirting gallons of the stuff into the air and then raining down to fill a huge crystal bowl. The table was mobbed with thirsty natives. It looked like Happy Hour at the Lobster Bar from Hell.

The stage was high enough to create a rare pocket of privacy behind it. "You *are* ready to play, aren't you?" Dork demanded when we got there. Like we'd shown up lugging our instruments in full orchestra drag in hopes of playing volleyball.

"We're ready," I said soothingly. "All we have to do is unpack our instruments and stands. Oh yes, it would be helpful if one of your people could place our sound system."

He looked annoyed. "We already have one."

I tried to keep the pity out of my smile. "Not as good as ours. Besides, it's already tuned to our instruments."

"Whatever." He snapped his fingers at a very attractive woman in a very revealing dress who had been hovering very closely by. The adoring looks she'd been beaming Rube's way made it clear they weren't exactly strangers. For his part, he seemed to be trying to telepathically implant urgent sexual urges in her brain. Totally focused on Rube, she didn't hear Dork's summons.

"Here, Thornton!" Dork barked. *"Now!"*

I moved in before he could order her to heel or fetch, and placed myself between her and the leering object of her desire. "Would you mind taking this," I handed her the Klipsh-Kleinmann Sonicaster, "and placing it on the front edge of the stage, in the center, the side with the silver logo facing out?"

"Um, sure," she murmured, hugging the breadloaf-sized, matte black sonic device to her creamy scenic bosom. Her gaze slid past me and went back to Rube.

"Now, Thornton!" Dork bawled.

"Uh, yes sir." She fired Rube one last sultry look and undulated away. Maire and I watched her depart, both of us thinking similar unworthy thoughts.

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Dork peeled back a lacy cuff and consulted his gold watch. "You go on in five minutes. I have some last minute details I must see to. Be ready by the time I return, and we'll show these refugees from a bad batch of bisque what real culture is like."

He stumped off. As he was leaving a steward materialized with a refreshment cart, appearing so silently it was like he too had wheels. He cut a glance toward the departing Dork, made a fist with his thumb stuck out, mimed someone drinking. Then he placed a tray with glasses and carafes of water and fruit juice within easy reach, winked and rolled silently away.

We gathered around and helped ourselves, then I began our ritual preconcert pep talk.

"OK," I said softly. "You know and I know that this is a terrible gig. Dork is a puffed-up putz without even the innate culture of a decent cup of yogurt. We're all seasoned pros, and know the piece so well that the challenge will be staying awake through it. Chances are our audience would be just as likely to appreciate the sound of rush hour traffic as what we're about to offer them. *But.*"

I looked them each in the eye. "But we are professionals, and we have our own standards to maintain. We've dedicated our lives to this art. We will go out there and perform wholeheartedly and brilliantly because the music deserves no less than our best. We will go out there and play with passion and precision because each of us deserves the absolute best the others have to offer. We will go out there and make our instruments sing because with luck we'll get some plus points and be that much closer to the magic moment when we can tell the ETDS to go fuck itself."

I put out my hand palm-down. "So how shall we play?"

"Brilliantly!" they chorused, covering my hand with theirs.

"How shall we play?" I repeated.

"We'll *kill* them!" they answered, giving the ritual response.

"How shall we play?" I asked for the last time.

"Like our lives depended on it!"

We held our hands together for a moment longer, then each turned to remove our instruments and stands from their cases.

Just as we were finishing up Dork came bustling back with bright eyes, flushed cheeks and hundred proof breath.

It was showtime.

Even when you're about to play for an audience so unfamiliar with the repertoire you could present them with a veritable clambake of muffed notes and they'd be none the wiser, there still comes a moment when you have to swallow back butterflies. When that audience is comprised of large excitable aliens known to be prone to precipitous violence the butterflies metamorphose into something more akin to agitated bats.

Applause was sparse and perfunctory when we mounted the stage. All of it came from embassy staffers who were probably just following orders. The sole exception was our pickup roadie, the luscious Ms. Thornton.

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She clapped in Rube's direction with a zeal that made me slightly envious. That must have been one hell of a matinee.

As for the crowd. . . .

Try to imagine a Whakmusik biker-punk headbanger revival concert envisioned by Bosch on heavy-duty hallucinogens. Before us were hundreds of rowdy, semi-drunk red lobbears waving their orange and black disposable cups in the air or primly dunking and munching wriggling mrr'hhg like animated scones in neon tea. A considerable number of them had their eyestalks turned our way and were clicking their finger and toe pincers impatiently. Several dozen scattered couples were having noisy writhing Yummi-Ade lubricated sex. Others were arguing politics or art with the reasoned restraint of mutant versions of the Three Stooges.

Dork gazed out over this surreal vista and paled, regrets about high attendance and low sobriety on their part, and insufficient gin on his, haunting his bloodshot eyes. Then he shook himself, adjusted his silver pompadour, forced a greasy smile and strode up to the microphone at the front of the stage.

His first attempt to address this unnerving assemblage set off a shriek of feedback that should have peeled the red fur patches of the hundred or so sk'rrli closest to the stage. Instead they ceased their pincer-snapping and gave him their undivided attention, looking peculiarly pleased.

His face gone almost as red as a lobbear's, Dork glared at someone offstage. The feedback ceased. The audience looked disappointed, their segmented feelers drooping.

"My friends," he began, the sound system warping his words into a shrill, loud, garbled version of the chittering and growls of sk'rrli. "As I have often told you, my world is a place of many fine things. Of wondrous objects you have never dreamed of, of goods and services you would desire if only you saw them and understood how badly you needed them. Many gifts have we brought you through our embassy, and tonight I offer yet another. Yet this gift is no mere object. It is instead a taste of one of Earth's finest cultural treasures."

He beamed at them like a second-hand aircar salesman about to close on a clunker with bad fans. "What I offer you tonight is an example of the cultural heights you yourselves might reach with our generous help, and through fair and honest and mutually profitable trade."

Maire leaned toward me and whispered, "Is this joker for real?"

"Unfortunately. Just smile and remember he's worth ten plus points to you."

Dork had worked himself up into a fist-shaking harangue. "You can make something of your brutal lives! You can rise above your present savage, uncivilized, uncouth state!"

"You can let us have bathroom and bedroom walls!" wailed one of the embassy staff down in front.

A wistful look flitted across Dork's patrician features, followed closely by pique at the interruption of his oration. "We are here to show you the way if only you will let us! We are

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here to improve your lives and prospects for the future! And we would, if only you would stop acting like a bunch of ill-tempered, uncooperative, utterly charmless excuses for sentient life who look like half-cooked lobsters and don't have the sense to—"

He caught himself, blinked and offered an unctuous smile. "But I should leave such matters for the bargaining table. Tonight all you need do is enjoy this generous taste of what my kind have achieved. So without further ado, I present a performance of Vivaldi's *The Four Seasons*."

He waited a few moments for applause. None came. A fixed smile on his face, he went to his big fancy chair and sat down. He grabbed the glass from the table beside him, drained it, then refilled it from his silver pitcher. The color that bloomed in his cheeks suggested it wasn't mineral water.

The three of us bowed to our ursocrustacal audience. I gave Maire a nod. She activated the mike in her music stand, then growled and chittered at our listeners in their own tongue. She'd asked to do this, having taught herself a sk'rrli phrase that roughly translated as: *May what we offer rend nicely and taste/feel good.*

When she finished we took our seats. I called up the score on our stands. Each gave me a nod to say they were ready. I had the stands give us a downcount. When it ended we began to play.

Now we're back to the place I started with at the beginning. The part where the crowd was getting ugly. Remember? Believe me, it wasn't the sort of thing you'd ever forget.

We were about three minutes into the first movement, playing tightly and sweetly, our timing and phrasing immaculate. A normal audience would have been rapt. The sk'rrli weren't a normal audience, even for us.

Immediately after the opening notes they had begun acting like a nest full of cranky hornets stirred with a stick, moving restlessly around waving their feelers and snapping their pincers in agitation. The longer we played the more aggravated they became. Before long they had started advancing on the stage, radiating enough raw menace to send the embassy staff scurrying to hide behind it. The mood grew so palpably ominous even Dork noticed it through his haze of gin and egotism. His face turned increasingly pale and waxy as the red tide surged closer.

Still playing, I leaned over toward him and hissed, "I don't think they're Vivaldi fans."

He blinked uncertainly. "Maybe they just, uh—"

His voice had failed him at the sight of a dozen or so lobbears preparing to clamber up on the stage. It looked unlikely that they were coming up to hand us bouquets. A plan to hand us our own heads seemed a lot more likely.

I didn't need the house to fall on me. "We're going to stop playing," I said, not much caring if he liked it or not.

I'm not sure he even heard me. Five of the lobbears were on the stage now, and they were advancing on him with snicking pincers and bared

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teeth. *Lots* of teeth. It made sense that they'd go for him first; he'd taken all the credit for our performance. Still I imagined they'd get around to us sooner or later.

I twisted around toward Maire and Rube, making a show of taking my bow away from my violinna. They did the same, looking relieved.

The lobbears were reaching for Dork by then, and seemed inclined to peel him out of his chair like a marinated prawn from its shell. He locked his hands on its arms in a death grip. "Help me!" he bawled. "*Do* something!"

Running seemed apropos. More of the lobbears had gained the stage and more were about to make the climb.

"MO!"

I whipped around toward Maire at her shout.

"Give me the baton! Now! Before it's too late!"

"What—" I began, now not only terrified but confused.

"Just do it!"

Now a lobbear was stalking me like some old movie monster. But this was real. I frantically banged on my stand's controls. Maire's supple fingers flew across her stand's keypads. The Vivaldi blanked.

Moments later a new piece of music appeared on its display, along with the command SLAVE MODE THREE. I stared at it for a second, then went for my violinna's controls. Now the music stand would, cued by notations in the score, directly control the various voices our instruments' could emulate, along with volume and a variety of effects.

There was no time to look at her or Rube, the downcount was already under way. I took a deep breath, the creature so close I could smell mrr'ggh and Yummi-Ade on its breath, and poised my bow, shiveringly aware of the pincered paws reaching for me.

The downcount ended a heartbeat before they got me.

The original instruments of violin, viola and cello were some of humankind's greatest creations. While these fragile wooden constructs were capable of creating lush, soul-moving sound, they were also limited in range, voice and volume. Moreover, they require certain temperatures, humidity and air pressure levels, not to mention atmospheric compositions, to sound true to their design. The modern cybronic analogues, the violinna, viola la bamba, and cellotta are unfettered by such considerations.

Take range. Five performances before the one on Sk'rrl we played for a race who used ultrasound for communication and navigation. The brains in our instruments transposed what we were playing (*Flight of the Bumblebee* was one of their favorites) umpteen octaves up, which had us producing sounds so high-pitched even dogs couldn't have heard us.

Or voice. My violinna can produce a sound absolutely indistinguishable from a priceless Guarneri or an Anderson laminar electric. But it isn't limited to sounding like a violin. It can also sound like an organ, an oboe, a trumpet or tuned vacuum breach sirens; its circuitry can synthesize the

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sound of literally anything.

And volume? Alone its body transducers are capable of nearly ninety decibels at zero distortion. Hooked to a Klipsh-Kleinmann Sonicaster like it was that night? It can produce notes capable of pulverizing a concrete wall.

Damn good thing, too.

The opening notes of the piece Maire had put in front of us were some of the most famous and recognizable ever written, but according to my stand what we were about to play had been written by C.E.A. Berry, with arrangement by H. Pei.

I had a fraction of a second to read this, and zero time to ponder it because the downcount ended and we launched into the composition. Launch is *precisely* the right word. What we touched off was an explosive blast of sound that literally blew the hundred or so lobbears closest to the stage clear off their feet.

Even when you know it, even when you expect it, the bombastic, brutally simple opening notes of Beethoven's Fifth can catch you by surprise and spike your pulse. When they're plated with subsonics and blasted out at just a few decibels short of the Death By Sound level you have what can only be described as *Weapons Grade Music.*

Ta Da Da Dummmmmmmm! Ta Da Da Doooooommmmm! Rube's cellotta thundered at earthquake intensity.

The lobbears on stage with us froze, feelers whipping straight up like antique car antennae. The front rows flattened by the first notes periscoped their eyestalks in our direction.

Rube bared his teeth and repeated the phrase, lower, louder. *TA DA DA DUMMMMMMMM! TA DA DA DOOOOOOOOM!* Maire weighed in the next phrases, with what sounded like a twelve ton cast iron violin responding to her bow.

My turn. I flung myself into the blizzard of notes on my stand like my life depended on them, with only the vaguest idea what to expect. My violinna howled out in the shrieking voice of an electric guitar plugged directly into a multimegavolt power supply, and I finally recognized what I was playing even as a million-horsepower whirling chainsaw of music spun out and felled even more lobbears.

The three of us slammed into *Roll Over Beethoven* like a trio of Godzillas playing fusion-powered instruments and intent upon stomping the local Tokyo flat with sound. You must know the song, it's been revived and redone hundreds of times in the century plus since the Immortal Mr. Berry wrote it. What we were performing was an arrangement based on the original, by way of the 1970s' Electric Light Orchestra, the 2010s' Brain Flug Scrapers, and the 2040s' Hidekeo Pei. What Pei, founder of the Pop In The Eye movement, had done was distill and synthesize all the most stirringly electric parts of earlier arrangements, orchestrate them for a full Pop Polysymphony, and create a piece guaranteed to bring an audience to its feet or put them on their knees. The only rea-

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son I knew this much about it was thanks to Maire, who often while EJing showed us how a particular composition had changed over the decades or even centuries, adapting to new times, new instruments, new attitudes.

The lobbears who had hold of Dork dropped him. He clapped his hands over his ears and began to scream—not that he could be heard over us. The lobbears fell back and began to writhe ecstatically, their feelers whipping around and their pincers snapping in time.

None of us sang the lyrics, but we sawed at our instruments in such a frenzy it was a wonder our bows didn't burst into flame. This wasn't the sort of piece you could play sitting down. There are some solo parts (called breaks or riffs in this repertoire) where our instruments reverted to electronicized versions of their natural voices for mixed Berry/ Beethoven figures. By the time they came around I was on my feet, twisting and turning, literally wrenching notes from my violinna and firing them at our audience. Maire clogged and pogoed and duck-walked, her face filled with exhilaration, her hands and fingers a blur. Rube whirled madly around the stage; at times it looked like he was wrestling his cellotta, at others having non-consensual sex with it.

We ended the song in full flatout overdrive, Rube recapitulating the original Beethoven with a bonecrushing bass cello voice that shook the ground, Maire with what sounded like an antimatter powered violin set to *Destroy*, and me with the sound of a shrieking guitar tuned so high that the crystal punchbowl exploded like it had been shotgunned.

The silence afterward was deafening. I know that's an overused cliché, but it really was. The lobbears stood facing us and frozen like a single moment from a Maine fisherman's worst boozy nightmare.

"Oh god what was that awful stuff?" Dork moaned, uncovering his ears.

"The third B," Maire answered with a hundred kilowatt grin. "You know, Bach, Beethoven, and Berry."

I smiled down at the huddled and miserable envoy. "It also seemed to be something of a crowd pleaser." The lobbears had begun shaking their heads like they were working off the effects of a collective sonic lobotomy. "Now as to the plus points our performance just earned. . . ."

Dork scowled and climbed shakily to his feet. "I hardly think that *noise* you just created constitutes a proper performance."

"OK, fine," I said brightly and turned toward Maire. "You still have the baton, of course, but this gentleman seems to have his heart set on the Vivaldi. Shall we begin where we left off?"

She bowed. "We aim to please. Natural mode please, gentlemen." We keyed our instruments, and when she nodded picked up at the point where we'd been mobbed by furious lobbears. In a matter of seconds the crowd began growling and advancing on the stage.

"Stop!" Dork wailed. *"Please!"*

"Yes?" I asked. We ceased playing,

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but kept our bows poised like loaded weapons.

"You get points," he hissed.

"The maximum number?"

He ground his teeth. "This is blackmail."

"This is negotiation," I chuckled, pulling our pointpad from my pocket and offering it to him. "If you would be so kind." Rube cut a lovely mournful Shostakovich figure that brought the growling crowd a step or two closer.

Dork snatched the pad from my hand and did the deed.

"Thank you," I said sweetly, taking the pad back and checking to make sure he hadn't cheated. The day I trust an ambassador is the day I trade my violinna in on a kazoo. Back into my pocket it went, safe and sound.

Sometimes a moment comes along when you're given the golden opportunity to do a favor that will inflict unbearable pain and suffering on someone who deserves it. One of those splendid moments had dropped into my lap, and couldn't pass it up. "Since you've been so generous," I said with heavy sarcasm, "we will be equally generous and play a few more pieces to whet these nice folks' appetite for more."

He stared at me aghast, a shudder of revulsion twitching his frame. "Why in the world would you want to do that?"

Life as an ETDS conscript musician means being at the beck and call of self-important knuckleheads like Dork. It was a wonderful feeling to have someone who once had power to make your life miserable at a total disadvantage. I couldn't resist reaching out and rapping my knuckles on the top of his head, a personal liberty that made the blood drain from his face, leaving it the whey-white of processed Brie. Laughter came from around the stage. His staff were eating this up. It seemed we had improved their morale after all.

"Hello in there?" I called. "Anybody home? Don't you get it? We just found something the sk'rrli really like. Give them more of this kind of music and I'll bet they'll farm all the mrr'hhg you want."

At first he looked appalled, then his eyes narrowed in calculation.

"Ah, dawn breaks inside that murky noggin!" I grinned, preparing to really put the boot in. "The thing is, your position as ambassador asks—nay, *demands* that you not let them think it's anything less than a splendid thing you're offering."

He shook his head, his elegant coiff now spiked in all directions. "I don't—"

"You have to sit there, listen, and make them think you're enjoying it as much as they do."

He went even paler than before. "Smile through more of that ghastly noise?" he croaked.

"Smile until it *hurts*. After all, Dork my man, instituting a successful trade mission here is the only way to get enough points for reassignment. Someplace nice, with lots of walls, and far away from what will soon be Rock and Roll Heaven."

"Mrr'hhg," he said. This time I don't think he was talking about the local wildlife.

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Since music of that sort was Maire's specialty, she picked the rest of that night's programme. Some pieces were classics most musicians would have heard at some point, others were more obscure ones I only knew from her EJ nights. We played, and we played for keeps. When we finally left the stage a bit after local midnight we were wringing with sweat, our hands and arms numb from the workout we'd given them.

Rock/Pop In The Eye wasn't our usual repertoire, but Triaxion gave the sk'rrli a concert they would be talking about for years. We performed take-no-prisoners, eardrum-blowing versions of such ancient masterpieces as "Pinball Wizard," "Satisfaction," "I Want To Hold Your Hand," "Born To Run," "The Red Shoes," "Rock Around the Clock," "Suffragette City," "Proud Mary," and "Don't Fear The Reaper." Maire sang the lyrics on some of the compositions, belting them out through the embassy's translator mike, which produced as much feedback as comprehensible sound, which was just fine with our audience.

When it was all over Dork tottered off clutching several packets of headache remedy, a fresh bottle of gin, and an armful of pillows to wrap around his head. The embassy's staff insisted on following us back to our ship for an after-performance bash. For just a few hours there we were the toast of Sk'rrl, and most everyone got toasted in our honor.

Late the next morning the remaining crumbs scraped themselves up and headed back to the embassy. About the time Maire and I were settling into the galley for coffee our ship lifted, taking us away from the scene of our triumph. Rube remained sacked out, done in from his encores with the apparently insatiable and insomniac Ms. Thornton.

Maire looked fairly chipper. That wasn't any great surprise, since she and her former guide, Edwina, had equipped themselves with a split of champagne and set off toward her compartment somewhere around three. More exploring, no doubt.

I was probably in the best shape since I don't drink anymore. Retiring to my compartment at about 3:30 with a dark-haired, dark-eyed, mocha-skinned communications officer named Clistalinda hadn't hurt much either. She had really liked the way I played, loved the way I'd mashed Dork's toes, and had absolutely no difficulty communicating her feelings in a clear and unmistakable manner.

After a cup of coffee to rosin my bow and tighten my pegs, I put down my mug and bowed to Maire across the table. "Congratulations," I said solemnly.

She eyed me quizzically. "For what?"

"For your new status as holder of the baton."

She snorted and refilled our cups. "That was only temporary."

I took a long slug, then said, "It doesn't have to be."

"I think it should. You're our leader, Mo. Rube and I wouldn't have it any other way."

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"Some leader. You're the one who hauled our chestnuts out of the fire last night."

She shrugged. "I just changed the evening programme, that's all. You're the one who spiked Dork to the wall and made him squirm. You're good at handling us and dealing with schmucks like him. All I want to do is see a few more sights while I serve out my time, then go back to Earth." The way she said this rang with the unspoken statement that maybe I didn't want to serve out or go back home. I let it slide.

"Getting out takes points, Maire. The leader gets extra plus points when we do well."

"And extra minus points when some tin-eared, puckerbunged worshipper at the holy altar of protocol isn't satisfied." She picked up her cup, took a swig, then regarded me over the rim. "You know, I've heard rumors that there were times you juggled points around, transferring some of yours to former trio members who couldn't handle living like this."

I shrugged. "People tell stories."

"People love legends. You're out of the limelight now, but like it or not, you still are one. Tell me, how many points do you have, anyway?"

I stared down at my cup. "I haven't really checked lately."

She just let my admission hang there for a minute. We drained our coffees. She refilled them once more, then said, "So, are we going to practice today?"

I grinned at her, glad the subject had been changed. "Don't you think we've earned a day off?"

"Probably. But just think how much Rube will bitch."

"Good point. I suppose I could order a session."

"You could. You're the boss."

I looked her in the eye. "Remember, I don't have to be."

She looked me right back and smiled fondly. "Actually, I think you do."

Maire was probably right. Our concert on Sk'rrl was over three years ago. Both she and Rube reached their plus point quota and moved on, but I'm still here leading Triaxion.

But enough ancient history. How about some music?

My new partners are pretty good. We can play damn near any tune you name.

But we'd really rather you didn't request *The Four Seasons*. ■

In the intercourse of polished society a young person will more frequently need an acquaintance with the creations of fancy than with the discoveries of science or the speculations of philosophy.

—Thomas Bullfinch (1863)

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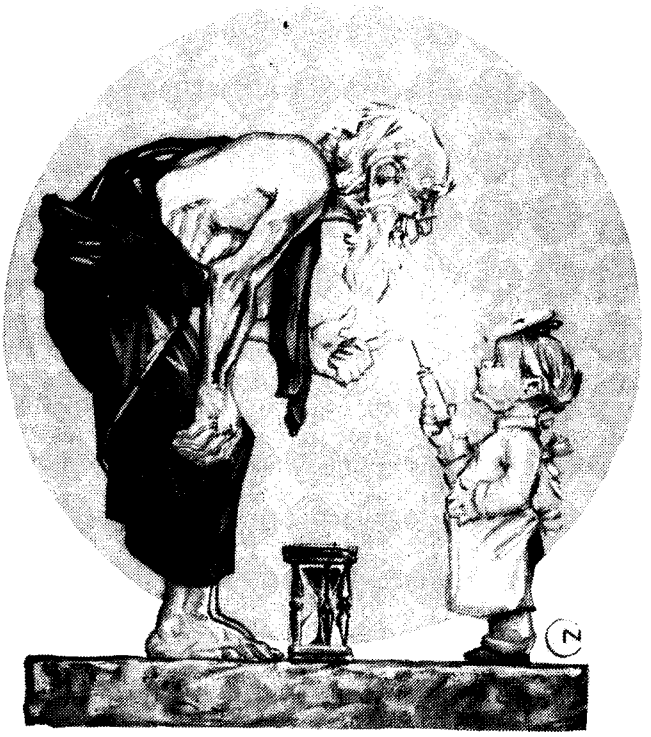
PLANET OF THE GEEZERS



As the aging Baby Boom generation nears retirement age in the next two decades, there is already a rising concern about how the retirement of this demographic tidal wave can be funded. But on the horizon there looms another development, not yet widely recognized, which threatens a far greater impact—a cure for human aging may be almost at hand.

The "biological clock" that nature uses to implement aging in humans and animals, to determine when an or-

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ganism has reached the end of its natural life-span and must die of old age. has probably been discovered. And it seems to be a clock that a clever repair man can tinker with, rebuild, or reset. With the understanding of this mechanism, it now seems very possible that a cure for aging, possibly even *reversal* of human aging, may become a standard medical treatment in the coming decade.

The presence of the aging clock was discovered 35 years ago by Leonard Hayflick, then a young cell biologist working in Philadelphia. At the time, the biological dogma was that normal cells can reproduce by cell division indefinitely. However, Hayflick discovered that fibroblast cell cultures from human skin, which he was growing in his laboratory, showed a definite limit to the number of times they could divide. Further, he found that tissue from embryos could divide more times than tissue from young human adults, which in turn could divide more times than tissue from older humans. This limiting condition became known as the *Hayflick Limit*. Later it was discovered the limit has some exceptions: cancer cells and the cells in the male associated with sperm production seem to be exempt from the Hayflick Limit and can continue to divide indefinitely.

The biological mechanism behind the Hayflick Limit was, until 1990, a mystery. It was clear that there was a biological clock ticking along within each cell, and that when that clock ran down, the cell ceased to divide and soon died. It was also clear that cancer cells were somehow resetting or ignoring this clock. But it was not clear what the clock was, or how it worked.

A clue to the action of the aging clock was provided by the Hutchinson-Gilford (HG) syndrome, a remarkable childhood pathology first described in 1886. It was found that a few children (about one in 8,000,000) show signs of greatly accelerated aging. The HG child begins to show early aging symptoms in the first year of life and typically dies of what looks like advanced old age by the age of 13. Symptoms include gray hair, baldness, "old" skin, facial changes characteristic of the elderly, senility, cataracts, heart disease, and strokes. The HG syndrome appeared to be a case where the aging clock was somehow ticking too fast, but its origins were mysterious.

Then in 1990 with the work of Cal Harley (McMaster University) and Bruce Fuchter and Carol Greider (Cold Springs Harbor Laboratory), the *telomere* was discovered and the clock identified. A telomere is a special DNA structure with the repeating amino acid sequence TTAGGGTTAGGGTTAGGG. It is found on the ends of chromosomes in the nucleus of a cell, rather like the plastic tips on the ends of a shoestring. It is thought to provide a "docking zone" or starting sequence for the enzymes that perform chromosome duplication when a cell divides, and also to provide an inert region that prevents one chromosome end from sticking to another.

Young cells, it was found, have long telomeres containing perhaps 1,600 repetitions of the TTAGGG sequence. But each time a cell divides, the telomere region is incompletely repro-

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duced and becomes shorter. Finally the telomere is used up, the duplication enzyme cannot dock, the cell can divide no further, and some of the chromosome ends may begin to stick together, disrupting its DNA function. When this happens to enough cells, the organism ages and dies.

There is considerable controversy at present over the question of whether cells are governed by one aging mechanism or many, whether the telomere mechanism is *the* unique aging clock or is only one of several that combine to form a very complex and poorly understood aging process. But a growing segment of the molecular biology community is becoming convinced that the telomere may be *the* key to reversing human aging. A piece of evidence in support of this position is the 1992 observation that the telomere lengths at birth for children afflicted with the Hutchinson-Gilford syndrome are much shorter than those of normal children, and indeed are even shorter than those of very old normal adults.

In any case, the telomere is a countdown clock which limits the number of times a cell can divide by becoming progressively shorter with each cell division. As mentioned above, some cells like cancer and male reproductive cells seem to be exempt from this mechanism. Detailed investigation has revealed the reason: the nuclei of these cells contain an enzyme called *telomerase*, part protein and part RNA amino acid sequence, which acts to rebuild the telomeres on the chromosome ends as fast as they are shortened by cell division. Cells with nuclei containing sufficient telomerase are, in effect, immortal.

Where does the telomerase in cancer cells come from? The DNA of every cell contains an amino acid structure for producing telomerase, but it is normally "switched off" and inactive. In cancer cells, however, telomerase production is switched on, flooding the nucleus with telomerase and permitting the cell to divide without limit. The telomerase enzyme, however, is rather fragile and cannot travel from cell to cell through the bloodstream. Thus, each cell must produce its own telomerase locally. Even if we could synthesize telomerase (we cannot at present), it could not be distributed to cells through injection.

The understanding of the telomere clock as it functions in normal and abnormal cells raises several potential applications that are now being actively pursued: (1) detecting the presence of telomerase or telomerase fragments in body fluids would provide an early warning of cancer; (2) a drug that could suppress the production or supply of telomerase in cancer cells would strip them of their "immortality" and thus represent a general cure for cancer; (3) a drug that could, for a controlled period, switch on the production of telomerase in normal cells would, at some level, reverse the aging process; and (4) a modified form of telomerase might be synthesized and administered directly, particularly if a form could be found that was not broken down in the bloodstream.

The Geron Corporation (Menlo Park, CA) specializes in the biopharmaceutical aspects of telomeres and

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telomerase. They have succeeded in cloning the RNA component of telomerase, and they offer a product for detecting telomerase. This has been applied successfully to the early detection of bladder cancer, as indicated by the presence of telomerase in urine. Similar attempts to use telomerase in blood as an indicator of cancer have been less successful because of the fragility of the enzyme in the bloodstream, but the detection technique has many other uses.

There is presently a broad-based effort to find a drug that suppresses the production of telomerase in cells (particularly cancer cells). One such drug, involving a reverse-sense transcription of the RNA component of telomerase has already been produced by Geron in 1994, and found to be effective in suppressing the growth of cultures of ovarian cancer cells in the laboratory. Research on similar suppression of cancer in animals is now in progress.

But it is hoped that there may be cheaper and less fragile drugs for suppressing telomerase in cancer cells. Many of the large drug companies have assembled "drug libraries," large collections of chemicals and drugs derived from plants and animals all over the world, for which no pharmaceutical use is presently known. Groups are now going through the extensive drug libraries of several large pharmaceutical firms, using the telomerase detection technique to search for a drug that will suppress the production of telomerase in cultures of cancer cells. For example, a drug may be added to a cancer cell culture while the telomerase level is monitored. A drop in that level would signal a possible new telomerase inhibitor, perhaps a general cure for cancer. A parallel effort, using much the same approach, is to use a culture of normal cells and search for a drug that would produce an increase in the telomerase level, thereby perhaps signaling a new drug that might reverse aging by rebuilding telomeres on command.

A different approach to age reversal, as mentioned above, would be to synthesize and administer a modified form of telomerase directly. The modification is necessary because normal telomerase is broken down in the blood stream. The present roadblock to this approach is that we do not have a complete molecular map of the structure of telomerase. Its RNA component has been sequenced by Geron and others, but its protein component remains a mystery. Therefore, the origin of its structural fragility is not understood, so it is not possible to design a more robust substitute (or even to know if such a substitute is possible).

OK, this is a science fiction magazine, so let's assume that telomerase is indeed the key to age reversal and consider some of the SF implications of this discovery.

First, cosmetics: humans of the female gender spend an amazing amount of money on products that are alleged to "de-age" the texture of the skin, while males invest in remedies that promise to restore their thinning hair. The hair and skin are fortunately on the surface of the body, accessible without using the bloodstream. So suppose we mix some oily

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penetrant like lanolin or DMSO with synthesized normal fragile telomerase and sell it as a cosmetic to rejuvenate the skin and/or as a hair restorer? Since telomerase is a natural enzyme (like melatonin, currently available at your local health-food store), I don't think this could be regulated or suppressed by the FDA. (And it wouldn't even have to work.)

Or suppose that in a few years an age-reversing treatment comes along. The course of treatment would probably be a good dose of telomerase inhibitor, maintained for long enough to make sure the patient had no undetected developing cancers, followed by a dose of telomerase enhancer that would cause the rebuilding of all of the body's telomeres. At a stroke the human lifespan might be increased to a few centuries.

What are the implications of that? What would it do to the population of the planet, the birth rate, the enthusiasm of some cultures for war, the retirement and Social Security systems, life insurance, the stock market (where a lot of retirement money is invested), the flow in our society of young people into the workforce and old people out? Would Earth become The Planet of the Geezers, ruled by the AARP?

Many SF writers, notably Robert Heinlein, Damon Knight, Frederik Pohl, Poul Anderson, and Bruce Sterling, have considered some of the implications of extended lifespans or cures for aging, but I believe there are rich possibilities for new SF in this area to prepare us for the changes to come. *Analog* writers take note!

Caveat: The author of this column is a physicist with only a superficial appreciation of the subtleties of molecular biology. My information comes mainly from Michael Fossel's book referenced below, and my perspective is perhaps distorted by my lack of experience in this fascinating but complex field.

AV Columns On-line: Electronic versions of 85 or so past "The Alternate View" columns by John G. Cramer are available on-line on World-WideWeb at the URL: http://www.npl.washington.edu/av. ■

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Poul Anderson

THE TALE OF THE CAT

There's more than one way to skin a cat— or recruit a spacefarer.

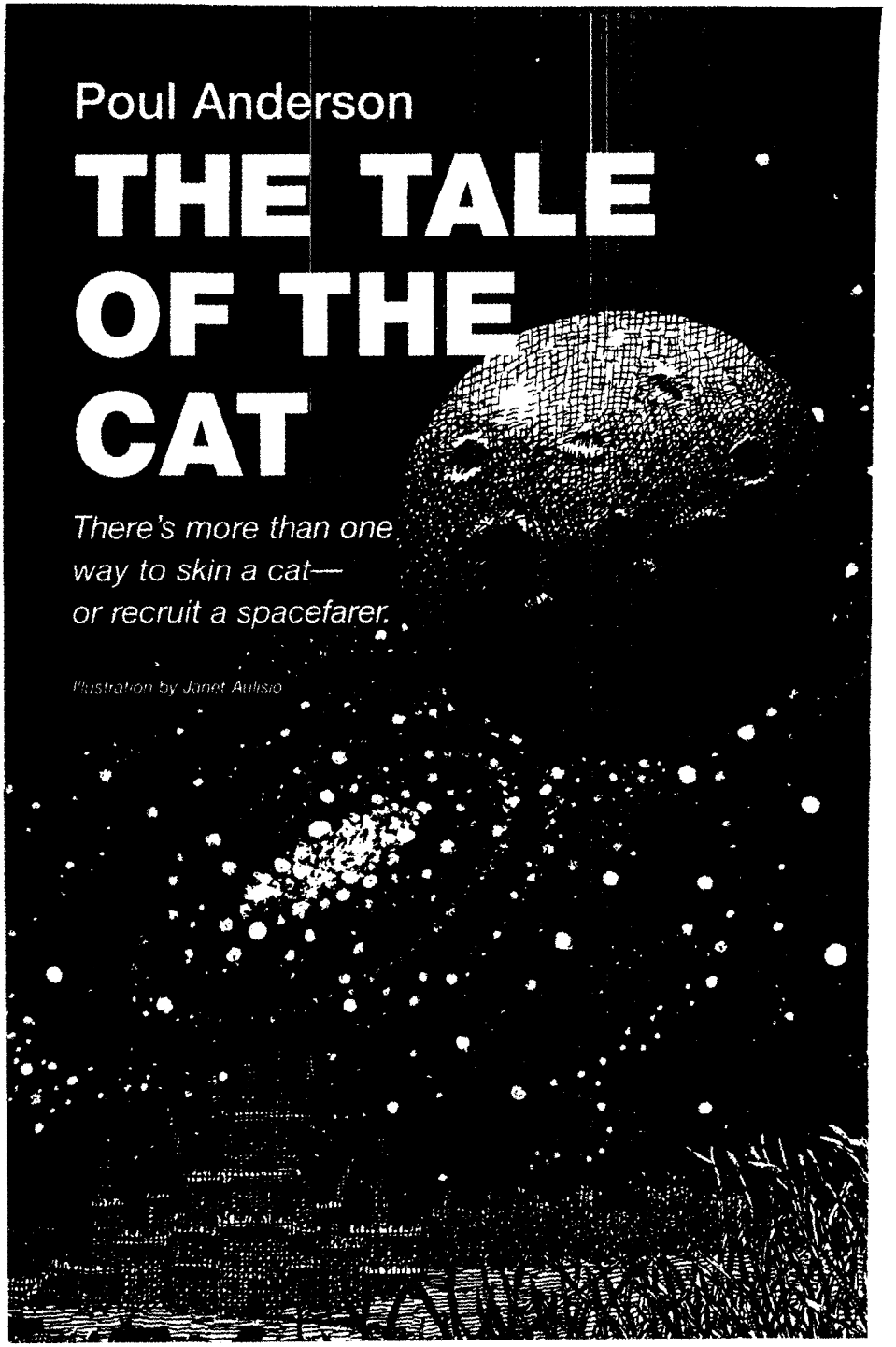

Illustration by Janet Aulisio

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Earth was the mother and her Kith Town the small motherland of every starfarer; but there were other worlds where humans dwelt. At those the ships were almost always welcome, bearers of tidings and wares that bridged, however thinly, the abysses between. It was not perennially so on Earth.

Thus, over the centuries, Tau Ceti became the sun to which voyagers from afar often sought first. Its Harbor was as homelike as any known extrasolar planet, and usually at peace. News beamed from Sol arrived only eleven and a half years old; if you had felt unsure, you could now lay plans. Whether or not you went on to that terminus, here was a good place to stop for a while, do business, make fresh acquaintances and breathe fresh winds. A Kith village grew up, stabilized, and settled into its own timelessness.

Spanning the distances they did, zero-zero drives running them on the heels of light and time aboard dilated by gamma factors in the hundreds, vessels could hardly ever prearrange a rendezvous. It was occasion for rejoicing and intermingling when two happened to be in the same port. When three or more did, it meant a Fair.

Fleetwing came to Harbor and found *Argosy* and *Eagle* in orbit. *Argosy* was about to depart, but immediately postponed it. Profits could wait; they were no longer large anyway. Fellowship, courtship, exchange of experiences, renewal of ties, the rites that affirmed and strengthened Kithhood, mattered more.

Ormer Shaun, second mate aboard *Fleetwing*, and Haki Tensaro, who dealt in textiles wherever *Eagle* might be, walked together through the village, bound for the story circle. Tensaro wanted to hear what Shaun would tell; they had become friendly in the past few days, and besides, a real yarnspinning with a bardic accompaniment was an art practiced in just four ships, which did not include *Eagle*. The two men had met for a beer in the Orion and Bull before starting out, and continued their conversation as they proceeded. It had gradually, unintendedly, gone from merry to earnest.

"A disappointment, I admit," Shaun said. Sounds of revelry beat beneath his words. "Not so much for me, or most of our crew. But the boy, he was really looking forward to all the ancient marvels."

"We're quite safe on Earth nowadays, I tell you," Tensaro argued. "No more persecution."

"They still don't like us, though, do they? To go by what everybody's been saying."

Tensaro shrugged. "I've seen things better there, but I've seen them worse, too. I think the next generation will be pretty tolerant."

"Up to a point. I doubt we'll ever again be exactly popular, anywhere on Earth outside of Kith Town."

"Why not?"

Shaun paused to marshal words. He contrasted with Tensaro, who was slim and intense, clad in formfitting lusterblack with white sash and cloak, and a headband on which a miniature light fountain made a dancing cockade. Shaun stood bigger than most

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Kithfolk, stocky, his features rugged and his hair a dark mahogany. For his garb today he had chosen a blouse that slowly shifted color across the visible spectrum, a vest of silver links, a broad leather belt studded with Aerian eyestones, a shaggy green kilt, and knee-length boots. A beret slanted across his brow. Both outfits were traditional festival garb, but the traditions belonged to two different ships.

"Earth doesn't have enough to do with space any more," Shaun said. "People get in the habit of taking their ways to be the only right and decent ways. Governments feed on that. Meanwhile we insist on being peculiar, and bringing in unheard-of notions from elsewhere, and asking troublesome questions."

The street down which they passed seemed to belie him. Turf covered it, springy and pebble-grained underfoot, breathing a slight odor not unlike rosemary into cooling air. On one side a lyre tree curved its double trunk and feathery foliage aloft, on the other side an arachnea spread its web across a cloud tinted gold by the westering sun. The houses that lined the street stood each on its piece of lawn, among its flowerbeds. They were of archaic styles, tending to pastel walls and red-tiled roofs; time had softened their edges. All were currently vacant. Most of the families that owned them were afar among the stars, leaving machines to tend the property. Everyone staying here, whether as transient or permanently, had flocked off to the Fair.

Between the houses glimmered a glimpse of water. Beyond it the cliffs of Belderland rose white. Opposite, native forest spread red-splashed ochers and golds above the roofs. Long since deeded to the Kith, the Isle of Weyan retained much wilderness.

"Yes," Shaun said, "I think *Fleetwing*'ll elect to make another swing from here—not as long as last time, of course, but we can give Earth forty or fifty years more to mellow further before we show our noses there again. The boy'll be disappointed, like I said. But, what the gyre, learning how to wait things out is part of becoming a Kithman."

"Well, if that's what your crew favors, so be it," Tensaro replied. "I expect you can sell what you're carrying on Aurora or Maia as well as here. It'll probably be exotic enough to fetch a price. But really, you're too pessimistic. I can understand how your last visit to Earth was embittering and made you decide on a long cruise. Nowadays, though—"

A trumpet cut him off. The noise from ahead had been waxing as they walked: voices, foot-thuds, song, boom and bang, the racket of merriment. Shaun and Tensaro came abruptly out onto open ground, where the Fair was. It surrounded the village. They had crossed from the tavern on one edge to this side.

Shaun threw up his hands. His laugh rang. "Haki, us old fools, we've gotten serious! What ails us? Did the beer wear off that fast? Come on, let's get back to our proper business today."

He quickened his pace. His companion grinned wryly and trotted along.

People swarmed about. Folk cos-

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tumes from the separate ships mingled with gaudy individual choices, often inspired on other worlds in other eras. A middle-aged couple strolled by, he in the blue-and-gold tunic and flowing white trousers, she in the red frock, saffron cloak, and massive jewelry of *Eagle*. Shaun smiled at a young woman he knew aboard *Fleetwing*. Her brief and gauzy gown twinkling with star-points, she walked hand in hand with a young man whose fringed yellow shirt and black knee breeches said *Argosy*. Memory stirred—courtships flowered like fire when crews met, and if the marriages that followed took place quickly, they endured, for the elders of both families had first considered what was wise. Shaun's wife was a *Flying Cloud* girl; but his brother had joined his own bride on *High Barbaree*, because that seemed best. . . . Children dashed around, shouting, marveling bits of rainbow.

Pavilions had been erected throughout the area, big and gaudy. Banners above them caught the sea breeze and the evening light. From one drifted savory smells and the sounds of clinking cups and cheery chatter. In another, a benched audience watched a classic drama, performed live; in another they heard a concert, which included music brought back from artists who were not all human; in another, visual artworks were on display, created aboard ship as well as on remote planets, and in this quiet atmosphere a few officers took the opportunity to discuss business or exchange information. In a clear space, a band played lustily for scores of dancers. Mirth whooped as some tried to learn, from others, measures new to them—the sarali, the Henriville, the double prance.

Nearby stood the Monument Stone. The bronze plate on it shone bright, having lately replaced a worn-out predecessor. The inscription was the same, *Here camped Jean Kilbirnie and Timothy Cleland of the first expedition to Harbor, afterward of* Envoy *and our future in the cosmos*, with a date in a calendar long superseded. Likewise, only scholars could read the language, ancestral to Kithic, but everybody knew what it said. A few meters off, wood was heaped to be burned after dark—fire, evoking prehistoric memories and instincts older still, doubly strong in a people who rarely saw it.

The narrators' pavilion lay a little distance onward. About a hundred persons sat inside waiting, mostly adults, mostly from *Eagle* and *Argosy*, though several youngsters and *Fleetwing* crew also felt they would enjoy the performance. They gave Shaun the salute of greeting as he entered, came down an aisle, and mounted the stage. Rusa Erody was already there. She made a striking sight, clad in a long dress of scales that glittered in the subdued light, herself a genetic throwback, tall and blonde. Her fingers drew vigorous chords from the polymusicon on her lap. The song she sang was as ancient as her looks, translated and retranslated over the centuries, because it spoke to the Kith.

"—The Lord knows what we may find, dear lass,

And the Deuce knows what we may do—

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But we're back once more on the old trail, our own trail, the out trail,
We're down, hull down, on the Long Trail—the trail that is always new!"

Words and notes clanged away. Shaun took the chair beside hers. The tumult outside washed like surf around sudden silence.

He lifted a hand. "Good landing, friends," he drawled. A comfortable informality was his style at these events. "Thanks for coming, when you've got so much else you could be having fun with. Well, you men have had my partner to admire, Rusa Erody, biosafety technician and bard. I'm Ormer Shaun, second mate and occasional storyteller. Those of you who docked here earlier have heard others tell of things that *Fleetwing* did or encountered or got wind of, sometimes generations ago. Rusa and I will relate a happening on our latest voyage, just finished."

"But it was well-nigh a hundred years agone, for Aerie is the farthest of all worlds where humans dwell, our last lonely home in the heavens," the woman half sang. Music wove low beneath her voice. Her role was to call forth a mood and bring a scene to life. If she deemed that meant repeating common knowledge, it worked as a refrain or a familiar line of melody does. "Not even our explorers have quested much beyond, where time must sunder them from us more than the hollow spaces themselves."

Shaun frowned slightly. A storytelling was not rehearsed, but improvised. The hint that outwardness was faltering fitted ill with the lightness he intended. *But Rusa generally knows what she's doing*, he thought. *A touch of sad or anxious, like a pinch of sharp spice*— He decided to follow suit for a moment, in prosaic wise, before he went on to his tale.

"Well, being that distant, Aerie gets visitors few and seldom. Previous one, as near as we could learn, was about a century before. We figured to do a brisk trade in the goods and information we offered.

"But also, after what we'd just been through on Earth, we didn't care to see it again soon. Insults, restrictions, place after place that didn't want us for customers, throat-grip taxes—yes, once a mob threw rocks at some of us, and I saw a woman of ours bleed and heard little children of ours crying—but many of you know this, maybe better than we do. To the Coal Sack with 'em. We'd come back after they were dead, if they hadn't meanwhile spawned too many like themselves."

A smile crinkled his face. His tone eased. "Moreover, frankly, a lot of us were curious. What'd been going on, way out at Aerie? What new and odd might we find? We'd been in the Quadrangle Trade for some while and were getting a tad bored with it. Time for a change of scene, a real change."

"The Quadrangle Trade," Erody chimed in. "Biochemicals from the seas of Maia's uninhabitable sister planet Morgana, worth harvesting and transporting because it costs more to synthesize them. Rare, useful isotopes from the system where Aurora orbits. Arts and crafts from Feng Huang. Biostock from Earth, to nourish the Earth life on yonder worlds."

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This was not entirely another chorus for Shaun. Neither *Eagle* nor *Argosy* had plied that circuit, and crewfolk of theirs might know it only vaguely. She did not add that it too was declining, losing profitability as the demand for such cargoes diminished. "We fared from the Quadrangle toward the Lion," she finished.

"A long haul, aye," Shaun said. "Considering how scarce traders had been on Aerie, and how small the population and industry probably still were, we loaded a lot of stuff more massive than usual, machinery and so on.

"Besides our several hundred men, women, and children as always, their life support, their household treasures, their tools and weapons that they may have need to wield when we arrive, their need to be together, to be families, and thus keep the life of the ship alive." Not information, for those who sat listening—affirmation, for every Kith member, living, dead, and unborn.

"So our gamma factor was well down, seeing as how our quantum gate's no bigger than anybody else's."

"Not like *Envoy*'s, for none of our ships is *Envoy*, crossing five thousand light-years to seek the next nearest starfarers and bearing no more crew than her fabled ten. Well could we wish for an engine like hers, but the gain and loss of trade say no, it cannot pay, and though we travel not for trafficking alone, it is by the traffic that we abide as the Kith." More rituality, as a priest at a service may recite an article of the creed to strengthen feeling in a congregation that may know it word by word.

"Ninety-seven light-years took us eight zero-zero months. Oh, we were good and tired when we got there—tired, anyway, and cramped and grubby and ready to settle in for a spell."

"Where ground and grass were under our feet, a breeze and unfeigned odors of growth in our nostrils, heaven blue overhead, and strangers around us, new souls for us to know."

"Who hadn't heard every joke and anecdote we could tell, folks who'd think we were glamorous and our wares were marvelous. And they ought to be interesting to us, of course, and have things to trade that'd fetch decent prices back at the heart stars."

"Yet theirs is a harsh holding."

"You know Aerie's not just far off from anywhere else human, it's a lump that never would've been settled if planets where people can settle at all weren't scarce."

"Vanishingly scarce. The sun of Aerie dim, its light across the lands of summer like the light of hazy autumn over Earth. The glaciers north and south, mountain-high. The cold seas that clash around the one tropical continent that our race could make its own. But the rings, the remnants of a shattered moon, the rings on a clear night are very beautiful."

"Well, the land's not that bad everywhere. The region where we set up our pitch, after *Fleetwing* took orbit, was shirtsleeve in its fashion. Naturally, that was the spot we negotiated to stay at, and, naturally, it belonged to the grand high rambuck."

Shaun continued with incidents from first contact, the establishment

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of groundside camp, trade, personal encounters, mostly as amusing as he could make them. Erody filled in descriptions.

"Our cabins were on pastureland, for they keep herds and sow crops on Aerie," she explained. "They dare not trust entirely to robotics and synthesis, when quake or storm or meteorite or the mites that gnaw metal may strike terribly in any year. Terrestrial grass stretched away southward from us, deeply green in the pale day, on one side the neatly arrayed houses and shops of the Magistrate's retainers and their kindred. Northward persisted native forest, a murky realm into which few ventured and none deeply. The castle loomed between us and the wildwood, its towers stark athwart the clouds, No need for curtain walls, when aircraft, missiles, and armed men stood watch. The castle was a community in itself, homes, worksteads, chapels, stadium, even laboratories and a museum."

"Aerie's not under a tyranny," Shaun said. "The way things had worked out—at least, as of when we were there—government was mainly by town meetings scattered around the continent. The Magistrate provided peace and order, police, through his militia, and higher justice—court of appeal, court of legal review—through his telepresence. Otherwise he generally left people alone, which most times is the best thing government can do. But after several generations had passed the office down from one to the next, he held a huge lot of assorted properties, and people didn't give him much backchat. He was a reasonable sort, though, in his rough-hewn style. We had no trouble ranging about in our own flitters, seeing things and making deals. And we were on a live, uncluttered world. Yes, that was a good three-four months."

"For us," Erody laid to this. Her music throbbed and keened. "We were not wholly benign. In some whom we met, we from the stars awakened dreams forgotten, wishes ungrantable, and belike we will never know what has afterward brewed from that discontent."

"One boy in particular," Shaun said. "Valdi Ronen, his name was. A bastard son of the Magistrate, raised at the castle in a hit-or-miss way, but with fairish prospects ahead of him. He might become an officer in the militia, for instance, or a rancher or an engineer, he being bright and lively. By Earth reckoning, he was about fourteen."

"A thin lad, shooting upward, his hands and feet too big for him, though he was not overly awkward," Erody remembered. "Pale-skinned, like most on Aerie, hair a flaxen shock, large blue eyes, sharp features. He often went hunting in the wilderness—sometimes alone. despite his mother's command that he have ever a companion or two; and we gathered that at those times he traveled farther in than men thought wise."

"He didn't after we arrived," Shaun said. "No, he hung around us like a moon around a planet. Most of us had studied and practiced the local language en route, of course. It hadn't changed a lot from what was in the database. I got pretty fluent, myself. We could talk, we two.

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"I was willing to put up with him when I wasn't too busy, his countless questions, his bursts of brashness, everything that goes with being that age. My son had been too, not terribly long ago, and had metamorphosed into a presentable human being. Besides, Valdi told me and showed me quite a bit, better than grownups probably could, about native wildlife and youngsters' games and lower-class superstitions and whatnot. Some of that might well go into the documentary our production team was planning, might help it sell when we got back. In fact, Valdi couldn't do enough for us. If we asked anything of him, he'd try his best, no matter how tough or dirty a chore it was."

"We meet not wondersmitten youth like that on worlds elsewhere as often as erstwhile, do we?" Erody asked low. "That may be as well. It has been painful to see the grief in them when we bade good-bye."

"Yes, I saw what was coming, and tried to head it off," Shaun continued. "'Valdi,' I told him, 'starfaring is our life and we wouldn't change if we could, but we were raised to it.'"

"'We were born to it,' I told him," the woman recalled. "'Our forebears for many generations were those who wanted it. They who could not endure it left, taking their genes with them. Kithfolk today are as chosen for space as birds are chosen to wing aloft.' His ancestors had brought some birds here, and several species had flourished."

"'But people don't grow wings!' he argued," Shaun added. "His voice broke in a squeak. He went red. Just the same, he pushed on. 'People build ships and, and l-l-learn to sail them.'

"I hadn't the heart to answer that nobody but a groundhugger would speak of sailing a spaceship. Instead, I set out the grim side for him. I talked about weeks, months, maybe years crowded into a metal shell or into still more cramped sealdomes, never able to step outside for a breath of clean air, only in a suit—because, I reminded him, planets where humans can walk freely are bloody few, and to make the profit that keeps us going we often have to call at other kinds. I talked about danger, death, and the worse than death that environments may bring down on us, bodies crippled, minds gone to ruin, and little our meditechs can do to remedy things. And coming back from even a short voyage, after ten, twenty, fifty, a hundred or more years have gone by, the people you knew old or dead, and every voyage leaves you more and more an alien. And how they react to this on the planets—Earth—Oh, I laid it on kind of thick, maybe, but I was trying to convince him he'd better be content with what he had.

"No use. 'You have each other,' he said. 'And you go to all those worlds, you go to the stars. Everything here is always the *same*." Shaun sighed. "When did a fourteen-year-old boy ever listen to reason?"

Erody nodded. "Yes, he dreamed of joining us." Her hand struck a chord that was like a cry. "Or else it was the vision that dreamed him, for he came to be consumed by it; nothing else was quite real to him any longer."

"M-m, I don't know about that,"

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Shaun countered. "He stayed smart and cocky. In fact, once in a while he'd revert to his age and be downright obnoxious, like when he slipped what they called a squishbug into Nando Fanion's shoe or, guiding me around in the woods, got me to fall into a lurkfang's muckpit, and in either case stood there cackling with laughter. I'd have decked him if he hadn't been the Magistrate's son." He shrugged. "Or maybe not. A boy, after all, hopelessly in love with what he could never have."

"Our scoldings eventually stopped the pranks," Erody said. "He came to me and asked my help in learning our language. I warned him that would be pointless, but he begged, oh, so winningly clumsily, until I set up a program for him. He applied himself as if he were attacking a foe. I was amazed at how quickly be began to speak some Kithish and how fast he improved. And when he heard how widely used Xyrese is around the heart stars, naught would do but that he study this also, and again he was on his way to mastery."

Shaun nodded. "It got me wondering if he might not actually be recruitable. Planetsiders had joined the Kith now and then in the past. And . . . some fresh DNA in our bloodlines wouldn't hurt.

"I hinted to his father, and gathered that *he* wouldn't mind. He'd never see his son again, but on the other hand, wouldn't have to worry about providing for him or sibling rivalry or whatnot. So I put it to Captain Du one day, privately, just for consideration. He wanted no part of it, though. We were too close-knit, he said, our ways too special, a newcomer would have too much to learn. And supposing he could—which I did believe Valdi was able to—would whatever he contributed during the rest of his life be enough to make up for the time and trouble his education, his integration with us, had cost?"

"Our margin is thin at best," Erody whispered through a rippling of cold string-sounds, "in material profits and still more in the spirit."

"I tossed the notion aside. Naturally, I didn't mention any of this to Valdi. But I felt kind of glad that we'd be leaving soon."

"We know not to this day how he discovered whatever he did discover. He may have had other, more secret friends among us. Ormer was not the sole Kithperson for whom he did favors. Somebody may have heard something in our camp and passed it onward to him. Or he may simply have guessed. Bodies—stance, gait, glance, tone—often say what tongues do not. We know only that of a sudden Valdi Ronen grew most kind to little Alisa Du, she of the brown bangs, freckled nose, and great black cat."

"The captain's daughter, and the midpoint of his universe," Shaun explained. "Nothing untoward took place, nothing erotic at all. She was half his age. But she'd been fascinated by him ever since he made himself a fixture amongst us. To her he was as strange and romantic a figure as any of us was to him. She'd follow him around whenever and wherever she possibly could, maybe lugging Rowl in her arms."

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The bard smiled. "Rowl was a ship's cat, a tom, but pleasant enough when chemically neutered as he usually was, quite intelligent, with a mortgage on Alisa's love second only to Daddy's and Mommy's. He shared her bed and each night purred her to sleep. Yes, she became Valdi's adoring admirer, her violet eyes never let slip of him when he was nigh, but Rowl was whom she went back to."

Shaun resumed. "Till now, Valdi hadn't been more than polite to her. That couldn't have come easy to him, but he knew what she meant to the captain—well, to quite a few of us. So he spoke kindly, and sometimes told her a story or sketched her a picture. He had a talent for drawing, among other things. If he expected that'd stop her tagging after him, he was wrong. Talk about counterproductive! However, he bore with the nuisance, because he must if he wanted to stay welcome in our camp.

"Suddenly this changed. He didn't seek her out or anything, no need of that, but he let her come to him and received her gladly. He'd hunker down and listen to her chatter, carry on a straight-faced conversation like with an equal. He spun longer yarns and drew fancier pictures than before. He showed her flowers and wildlife, took her for a ride in an open hovercar, led her through local skipdances and games like bounceball, till her laughter trilled. And, yes, he took special pains to make friends with Rowl. He brought treats stolen from the castle kitchen, he stroked the cat under the chin and down the belly, he'd sit for an hour or two after Rowl got on his lap and fell asleep, till Rowl deigned to jump off— Ah, every ship has cats. You know what I mean.

"I couldn't quite figure this out. Surely he didn't imagine it would butter Captain Du into approving his adoption—which'd call for a vote anyway, of course. At best, he made the Old Man and the Vanguard Lady regard him as less of a lout. What use that? Vacuum, poison air, hard radiation, celestial mechanics, they've got no respect for niceness."

The music went briefly sinister. "I wondered also," Erody related. "Could it be a subtle vengeance, striking out at the thwarting of his hopes? Soon we would depart. None now alive on Aerie would see us again, nor would we ever see them. Did he mean to send Alisa off with her heart ripped asunder?" The notes gentled. "No, I could not believe that. Valdi had no cruelty in him—"

"No more than most boys," Shaun muttered.

"—and besides, he must realize it would not happen. Alisa would miss him for a while, but she was healthy and a child; new adventures awaited her; and she had her Rowl."

"Then things exploded," Shaun said. "The sun was going down, it was getting bedtime for kids—Aerie's got a twenty-six-hour rotation period, you may recall, so we'd easily adapted—and all at once Rowl wasn't to be found. Consternation!"

"The news spread among us like waves over a pond where someone has thrown in a stone," Erody adjoined. "No enormous matter, no crisis of life and death. But throughout

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our camp, we began to peer and grope about. The bleak eventide light streamed over us, casting shadows that went on and on across the grass, while the castle hulked ever more darkling to north and beyond it night welled up in the forest. 'Here, kitty, kitty!' we cried, ridiculously to and fro, around the shelters, probing under cots and into crannies, while the sun left us, dusk deepened from silver-blue to black, and the rings stood forth in their ghostly magnificence. It mattered not that Captain and Lady Du had offered a reward. Alisa wept."

"No luck," Shaun said. "The cats had roamed freely. They seldom wandered far outside our perimeter, and never toward the woods. Things there probably didn't smell right. Rowl, though, even when his tomhood was suppressed, had always been an active and inquisitive sort. Had he, maybe, come on something like a scuttermouse and chased it till he couldn't find his way home? I don't think Alisa's parents suggested that to her. Nor do I think she slept well through the night."

"In the morning, we did not entirely go on preparing for departure," Erody told. "Some who found time to spare went more widely than before, into the very forest. None entered it beyond sight of sunlight aslant between those hunched boles and clutching boughs, down through that dense, ragged leafage. If nothing else, the brush caught at a man, slashed, concealed sucking mudholes, while the bloodmites swarmed, stung, crawled up nostrils until breath was well-nigh stopped. Noises croaked, gabbled, mumbled from the shadows. Hunters in these parts had means and tricks for coping, yet they themselves never ranged deeply. When Captain Du asked whether any of them would help search, they said nay. If Rowl had strayed into the wildwood, whatever got him could too easily take a human. Those creatures can eat our kind of flesh."

"Just a cat gone," Shaun said. "The girl would get over it. We had work to do.

"About midday, Valdi arrived. I asked where he'd been. He told me his school had gotten flappy about him skipping too many lessons, and he'd had to take a remedial session at the instruction terminal. Once free, he'd come straight to us. I gave him the news, not as any big thing."

"I was there," Erody said. "I saw him flush red." A note twanged. "'I will go look!' he cried. 'I know the forest, I'll find him!'" Her instrument sounded a bugle call.

"The boy's voice cracked again," Shaun observed anticlimactically. "Sure, I thought, sure; adolescent heroics. He dashed off. After a while he returned, outfitted like a huntsman—green airbreath skinsuit, canteen and ration pouch and knife at hip, locator on right wrist and satphone on left, rifle slung at shoulder, and a plume in the hat on that unkempt head of his. Ho, how dramatic! 'I will find Rowl,' he promised Alisa, who'd heard he was there and come out in fairytale hopes. And off he loped."

"Stars kindled in her eyes behind the tears," Erody said. "I thought how callous he was to raise her spirit thus,

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when it must be dashed down again onto the stones. Heedless, rather—a boy, a boy."

"I sort of thought the same," Shaun went on. "However, like the rest of us, I was busy readymaking. Besides, Alisa's no crybaby."

"A gallant little soul. As the day wore on, she swallowed her sorrow and took up her own duties. But she did not smile. Often and often I saw her gaze stray northward to the forest."

"I glanced that way myself, now and then," Shaun admitted. "More and more, I fretted. How long did the pup mean to try? What sense did it make? Had he quit, slunk into the castle, not wanted to tell us he'd failed? Really, he couldn't have expected to succeed. He wasn't that stupid-cocky. Or might he also have come to grief?"

"It was an evil wood." Music hissed.

"Hostile, anyway. You and I weren't the only Kithfolk who worried. Most of us liked Valdi Ronen. We called an inquiry to the castle. Had he checked in? No, he had not."

"Once more, darkness crept over us. The evening star glowed in western heaven. The rings were a banded bridge of pallid hues, around them the true stars and beyond those the galactic belt, as chill as the airs that sent mists aswirl about our ankles. Afar, some animal howled. Did it crouch above its prey? Windows and windows glowed yellow on the black bulk of the castle. Lights flickered like glowflies in the hands of servants and soldiers, out searching for Valdi. Their shouts drifted to us faint and forlorn."

"We Kithfolk huddled in. Our blundering efforts couldn't help. The boy hadn't phoned. No satellite had spotted anything. Well, Aerie didn't have many in orbit. Besides, the leaf canopy hindered their spying. Come morning, when a wider spectrum was available, we'd see what they could see."

"I have heard that now Alisa wept for her friend. Her mother rocked her in her arms for hours before she won to sleep. A psychodrug wouldn't have been the same."

"Me, I lay awake too, thinking some harsh thoughts. I recollected tales of what could find a human lost in those woods. And night whistlers, clingthorn—I didn't care to go through the list. Finally I took a soporific. My wife was smarter; she'd already done that.

"Our clock roused us when dawn was sneaking up into the eastern sky. We threw our clothes on and stumbled out, aimed more or less at the nearest mess cabin, desperate for coffee. People grunted and stirred in the shadows around us. Not that I was eager to be fully conscious. When the sun rose, its rays felt as cold as the lingering night-mists.

"And then . . . there across the wet, trampled ground came Valdi Ronen."

"His hair hung drenched with dew, his clothes dripped, he snuffled and sneezed," Erody said. "But pressed to his breast he carried a cage, roughmade of withes, and in it stirred and yowled a black furriness."

"We crowded around, jolted wide awake. Huh? He'd found Rowl? How ever? By what crazy chance? And why hadn't he called home? We babbled. He looked straight at me in particular—"

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"The level young sunlight blazed from his eyes."

"He answered us quietly, the way a man should. Yes, he'd assumed the cat had strayed into the forest. Being a better woodsman than average, he knew what traces to look for, bent twigs, pug marks in the duff— Well, I'm no tracker myself. I can't detail it. He didn't actually go any big distance away, he said. But the hunt was slow, with many false leads. By the time he'd found the beast, night was falling.

"Then he discovered his satphone was dead. Sometimes on Aerie, in spite of every safeguard, metalmites get into equipment. He should have checked before he started out, but didn't. A boy in a hurry.

"To stumble back through the dark would be too risky. He wove a cage for Rowl out of shoots, so the idiot animal wouldn't wander off once more, and settled down as best he could. Once, he said, something huge passed by—he didn't see, he heard the brush break, felt the footfalls through the ground—and he unslung his rifle; but nothing happened. At daybreak he started home."

"Alisa jubilated. Will I ever again see such utter happiness, and afterward such adoration?" wondered Erody. "Alisa's mother hugged Valdi to her and kissed him in sight of every soul. Her father wrung his hand, while swallowing hard."

"Oh, yes," Shaun said. "Only a cat rescued, a pet. The Dus, the ship, owed Valdi the reward, our thanks, and nothing else. Still, the lad had proven himself. Maybe he'd been reckless, but that goes with being a boy. Besides, he had in fact carried out a difficult operation. Taking a chance when you have to goes with being Kith.

"And, then, we were in turmoil, also in our feelings—close to departure, we'd nevermore see the friends we'd made, this or that love affair was ending— You understand.

"The upshot was, we adopted Valdi Ronen. He's apprentice crew. And, I may say, in spite of his handicaps, quite promising."

"Which pleases Alisa and Rowl," Erody laughed.

For a short span there was silence, beneath the rollicking of the Fair.

Shaun grinned at his audience. "No doubt you're puzzled what the point of the story is," he said. "And no doubt, we being a race of traders, some of you suspect.

"If so, you're right. I'd had my own suspicions—not unique to me, but I was the officer who took Valdi aside and braced him after the ship was outbound."

"The sun of Aerie lost to sight," Erody murmured, "and around us, anew, the stars."

"'This was too convenient,' I told him. 'I am now your superior and you will obey orders. I want to know what really happened to that poor cat.'

"He laughed. Not a cackle; a man's laugh, from down in the chest and straight out the throat. 'What poor cat?' he answered. 'A victim? Why, sir, I lured him with delicacies my father enjoys only on feast days. Yes, then I caged him and kept him hidden away till I could carry him off to the woods.

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But I kept him fed with the same treats.'

"And in fact," Shaun remarked, "it took Rowl a while before he stopped turning up his nose at his regular rations.

"'Didn't anybody notice that when I let him out he didn't race for food or water?' Valdi asked me. 'I was three-quarters afraid somebody would. But with you about to leave forever, what had I to lose? Uh, sir.' I saw him struggle to keep a sober face.

"'Well, it was an emotional scene, as you'd counted on,' I said. 'We Kithfolk are slobbery sentimental about things like that.' I gave him my sternest look. 'They include the welfare of an innocent little girl.'

"He had the grace to stare down at the deck. 'I'm sorry about that, sir,' he mumbled. 'I didn't really think of her, how hurt she'd be, till too late.' Maybe this was true, a boy, raised in hard company, often neglected, and possessed by a demon. 'I will try to make it up to her, sir,' he finished.

"'Well,' I said, 'those of us who guessed have kept quiet, which may count as conniving. Punishment would make Alisa cry more. No society could run for long without a certain amount of hypocrisy to grease the wheels. But you had better justify our estimate of you, Apprentice Ronen.'"

Shaun paused. His glance roved through the pavilion entrance, past the dancing and hallooing, to the sky.

"I didn't spell out that estimate for him," he said. "He needed chastening. But our ship needs more bold, clever rascals than she's got.

"Valdi's rambling about the Fair today, in the middle of all the glamour he ever wished for. I imagine he's observing too, learning, thinking. I hope so."

Erody's instrument clanged.

Shaun brought his attention back to the people who had come to hear him and began another story. ■

It's astounding how little it takes to make people proud *when they've been doing things they should be ashamed of.*

—Kelvin Throop

Thutmose was ... one of the earliest exponents of internationalism, or going into other countries and slaughtering the inhabitants.

—Will Cuppy

Sacred cows make the best hamburger.

—Mark Twain

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THE REFERENCE LIBRARY Tom Easton

Wizard and Glass, Stephen King, Plume (Signet), $17.95, 670 + xii pp. (ISBN: 0-452-27917-8).
The Gaia Websters, Kim Antieau, ROC, $12.95, 230 pp. (ISBN: 0-451-45511-8).
Eternity Road, Jack McDevitt, Harper, $22, 338 pp. (ISBN: 0-06-105208-6).
Beneath the Gated Sky, Robert Reed, TOR, $23.95, 349 pp. (ISBN: 0-312-86269-5).
Days of Cain, J. R. Dunn, Avon, $23, 328 pp. (ISBN: 0-380-97433-9).
A Quantum Murder, Peter F. Hamilton, TOR, $23.95, 352 pp. (ISBN: 0-312-85954-6).
A Geography of Unknown Lands, Michael Swanwick, Tigereyes Press (P. O. Box 172, Lemoyne, PA 17043), $12, 154 pp. (ISBN: 0-931763-06-1).
Collecting Science Fiction and Fantasy, Gary Lovisi, Alliance Publishing (P. O. Box 080377, Brooklyn, NY 11208-0002), $14, 136 + viii pp. (ISBN: 1-887110-12-7).
Poetica Dementia, Darrell Schweitzer, Zadok Allen: Publisher (Darrell Schweitzer, 113 Deepdale Rd., Strafford, PA 19087-2627), $4, 26 pp. (ISBN: none).

Stephen King returns to the saga of Gunslinger Roland and his quest for the Dark Tower (inspired by Browning's "Childe Roland to the Dark Tower Came,") with his fourth installment, **Wizard and Glass**. The story itself is more conventional heroic adventure than the earlier volumes (*The Gunslinger, The Drawing of the Three,* and *The Waste Lands*), but it fits neatly into the whole, explaining a great deal about the roots of Roland's obsessive nature and the place of the Dark Tower in the decline of the world. It also shows King succumbing to an urge familiar to readers of Heinlein and Asimov, knitting together the threads of a career. As he notes in his Afterword, "Roland's world (or worlds) actually *contains* all the others of my making." (Prominent here is *The Stand*.) Roland's world also contains other "fictons" (to use Heinlein's term), such as Oz.

As the novel opens, Roland and his companions, Susannah, Jake, and Eddie, are escaping from *The Waste Lands* aboard Blaine the Mono, an AI-operated monorail that intends to crash and kill them all unless they can satisfy its craving for riddles. They succeed and debark in Topeka, Kansas, to find a world of abandoned

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ruins and a newspaper that speaks of hellacious plague. Now they must walk, and soon Roland chooses to speak of his youth and his first true love. At the age of fourteen, newly a gunslinger, he was sent with two friends to the provinces to stay out of danger. But when they came to Hambry, they found signs of conspiracy to divert resources to the rebellion that threatens all that remains of civilization. The evil men in charge are lulled for awhile by the youth and apparent innocence of Roland and his companions, but that ends when the boys interrupt a bit of murderous play. Thereafter the tension mounts.

The tension gains more than a little from Susan Delgado, a beautiful and spunky maid who meets Roland on a nighttime trail and instantly captivates his heart. However, their love is clearly doomed, for Susan has been bought to be the concubine of Hambry's lecherous mayor. Or is it doomed? Roland and Susan are drawn together, much to Roland's distraction and his companions' frustration. One of those companions smacks Roland upside the head to bring him out of it, and the tale begins to chug like one of King's patent freight trains. The nature of the conspiracy becomes clearer and clearer, murder is plotted and done and the innocent are framed, harvest-time bonfires loom ahead, when traditional straw-filled stuffy-guys may be replaced by flesh in the flames, and gunslingers—though young—display the spirit, courage, audacity, and skill that explain why they rule civilization.

And love? Ahh, Susan is beautiful and spunky and brave, a fit mate for a Roland, but there is a witch with a pink-glowing crystal ball, there are forces of evil at play, the world—in both Hambry and Kansas—is infested by "thinnies" that devour all life and hope and leak worlds into each other, and . . .

I refuse to spoil this one. Suffice it to say that it's a grand tale, more conventional than its predecessors but a very pleasurable experience. And the Dark Tower remains ahead, with at least three more volumes remaining before Roland gets there.

And if you think *Wizard and Glass* looks a bit long, it's still a fast read. Furthermore, I only found one out-and-out boo-boo: One of Roland's youthful companions carries a bird skull on his pommel; on p. 180, Roland tells him to get rid of it, and he does; but by p. 189, apparently quite on its own, it is back. Perhaps someone will have caught this and fixed it by the time the bound galleys I read have become bookstore copies.

Kim Antieau's **The Gaia Websters** is an interesting hybrid. In a future America whose technological heyday is long past (much as in King's novel), she introduces us to Gloria Stone, whose memories began ten years before, when she awoke in a cave. Gloria can heal by laying on of hands, though she has learned to use herbs as a cloak of subterfuge, and her skills have earned her a place in a rural hamlet of the Arizona Territory. Now an emissary of the Territory's governor is after her, urging her to come to the governor. She refuses, for she is needed

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where she is, especially with a new disease popping up, its victims filled with what she can sense as a bright white hole, their memories vanished. Then another illness appears, striking everyone in town, and the governor's emissary says, "Come with me, and they'll be OK." He has, it seems, poisoned the town's water supply.

She finally succumbs, finds that the governor wants her to join his corps of "soothsayers," refuses, flees, and in due time learns the truth of what she is.

Gloria seems very human. She loves, despairs, suffers, exults. She has a friend in a coyote, Cosmo. She has lovers. She even has children, a pair she adopts after their parents commit suicide. But she has strange dreams of a string of numbers and letters that prompt the reader to wonder whether she is truly human and not a robot or an android.

The answer to that question lies at the core of the book and its title and prompted me to call this tale a hybrid. Healing by touch is fantasy. A coyote who might be Gloria's lover Benjamin (she has never seen them together, after all) is fantasy. But robots or androids created as slaves, able to access the World Wide Web and bring an owner's foes crashing to their knees, able in the end to destroy civilization, and able later on to serve a greater goal (Gaia), that is science fiction. It is weakened by the fantasy components, but it is still SF and it is well enough done to satisfy.

Jack McDevitt's **Eternity Road** is also set long after America's technological heyday, but here the cause was a plague that stopped the world in its tracks (again, as in King's novel). Now the Illyrian League, centered on the banks of the Mississippi somewhere near Memphis, represents civilization on the rise once more. It has horses and guns, roads and trade. What it does not have is the printing press, and there is a notable scarcity of records of the ancient past and of the civilization constructed by the Roadmakers whose ruins—towers soaring into the sky, twin-ribboned highways sweeping across the landscape, imperishable metals, windrows of apparent vehicles beside the roads—pervade the present.

I thought this something of a stopper. The level of technology McDevitt indicates here is roughly that of eighteenth or nineteenth century America. The printing press was already centuries old at that point. The Illyrians know what a printing press is, and the name alone is enough to provide clues to how it works. I thus think it quite unlikely that they would not have at least crude presses.

Yet I read on anyway, for McDevitt's record is fine enough to inspire some trust. And here's the premise: there is a legend that after the plague and the collapse, a small group gathered all the books they could and took them to a place called Haven to be preserved. Some years before the story, another group went in search of Haven, but only its leader, Karik Endine, returned. The rest had died. The mission had failed.

Now Karik's body has washed up in the river. As a bequest to Chaka Milana, the sister of the old expedition's

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artist, he leaves a copy of Mark Twain's *Connecticut Yankee*. But as far as anyone knew, this book no longer existed. The expedition must have succeeded after all, even though Karik had never said so.

There are mysteries here. Not surprisingly, they lead to a new expedition. Chaka, Karik's old friend Silas Grote (an academic), and Karik's mercantile son Flojian lead the way north and east, following blazes left on trees years before.

Their journey takes them all the way to the Bay of Fundy. Along the way they discover numerous remnants of the glory that was, some still working, and the reader is properly impressed with the scale of the catastrophe and the vulnerability of our civilization to plague. They also discover that the Illyrian League is not alone in the world after all. There are other centers of civilization reascendant, and the future is bright.

Do they find Haven? I won't say, for though this is their goal, their success is almost beside the point. McDevitt is telling a parable of vulnerability. He isn't terribly explicit, but to be sure we don't miss it, he does stick a finger in our ribs from time to time to remind us of the perils of population and pollution and of the evanescence of glory.

Yet life and love remain, and they make McDevitt's parable quite readable.

When I reviewed Robert Reed's *Beyond the Veil of Stars* in December 1994, I said that Reed was heavily into "things are not what they seem" in that tale of an Earth whose sky suddenly changes, no longer a thing of stars and planets but a literal reflection of the planet's surface, and whose ground is as suddenly sprinkled with black glass disks that can serve as gateways to other worlds. Of course, when you go through the gateway, you don't come out looking like you—the gateway changes you into a member of the equivalent local sentient species. Thus there may be aliens among us, but their disguises are perfect.

He's at it again in the sequel, **Beneath the Gated Sky**. The protagonists are once more Cornell, the son of a raving UFO-nut, and his true love, Porsche Neal, who was revealed last time as one of those aliens. They are no longer working for the Cosmic Event Agency, which had sent them to High Desert in search of alien beings and technologies. Indeed, they are now struggling to assemble a docudrama that, once hacked into the world's TV net, will reveal the CEA for the conniving SOBs they truly are. And Porsche is telling Cornell all, revealing her childhood on the world of Jarrtee, her membership in a group known as the Few, aliens who settle on worlds throughout the cosmos, infiltrating, fitting in, keeping their heads down. She tells how she goofed, spilling the beans to her first lover, who ratted to Jarrtee's paranoid security forces, and forced her whole family to flee to Earth—a bit less technologically advanced—where the resident Few helped them set up fake identities and learn the ropes.

The Few sound like a pretty nifty bunch. They have advanced technolo-

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gy, tools that help them protect themselves against discovery and use the links between the worlds, but they're benign. They don't want to take over or stir up trouble—just blend in and live, marrying and raising kids and eventually dying, on peaceful, comfortable worlds such as Earth. Yet something is there that stirs up trouble, as in Earth's recent history, as in Jarrtee's too, and Porsche's cousin Trinidad seems fond of trouble.

Is this just individual variation? Or should we be taking seriously that line in the cover blurb about how Porsche and Cornell "discover a conspiracy so profound that it casts doubt on those who [sic] they've trusted with their very lives"? The book is almost half over when they try to launch their media revelation of the CEA villains—and they fail. Their equipment fails to work. And here come the men in black, black helicopters and all, the goons from the CEA, taking them captive to aid an invasion of Jarrtee and a theft of technology advanced enough to put the U.S.A. once more on top of the global heap, and Trinidad is in cahoots with them!

What is going on? The truth will seem quite obvious, but you will anticipate the revelation only if you can think in terms of categories, not just specific exemplars. Most people can't, so that clue is too vague to need a spoiler warning. Once you read the book and see what I mean, however, you will also see that the inevitable sequel must be a wide-ranging tale indeed.

Reed's stories make excellent use of his cosmic imagination. Enjoy.

* * *

With **Days of Cain**, J. R. Dunn tackles one of the big problems of human existence. His premise is that there exists an organization of time travelers, the Moiety, dedicated to preserving the thread of the historical past in order that the past's fruition in some distant, distant future not be disrupted. The Moiety's structure is hierarchical, with lower-level Monitors overseeing centuries, higher-level ones overseeing millennia, and so on. The grunts are recruited from their eras. The infrastructure of offices and bases sits in the "Extension," some sort of side-dimension.

The basic idea is not new. What Dunn does with it, however, is interesting. Meet Gaspar James, being handed the assignment of stopping whoever is trying to kill Hitler and prevent the Holocaust. Efforts so far have kept anything drastic from happening, but the would-be history-changer is still loose, and there are hints of change from Auschwitz. And by the way, the chief perp seems to be one Alma Lewin, once one of Gaspar's trainees, a lady of charisma and will.

And here is Auschwitz itself. Gerd Reber, the clerk who cannot truly believe what the Reich is doing all around him. Boldt, the Gestapo thug who delights in torment. Rebeka, the Jewish girl who has just arrived and, aghast, sees her future. And yes, here is Alma Lewin, equipped with medicines and cash, setting out to protect the residents of Rebeka's barracks, to strengthen and empower and ultimately . . .

But here is Gaspar, setting up shop nearby, setting out monitoring

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apparatus, seeking Alma, seeing the camp and its horrors, being affected. What is going on? How can people do such things? How can the future not intervene here as elsewhere, including several other places Gaspar has been stationed? Is the Great Wheel truly unstoppable? Must the suffering continue, even if it does serve as an object lesson for future centuries?

These are difficult questions, and Dunn does an excellent job of bringing the pain involved to life—so excellent in fact that it becomes difficult at times to keep reading his tale. Dunn's answers are less convincing, but that matters only at the end, and then perhaps not to many whose thoughts lean in a similar direction to begin with.

Perhaps more significant is that when he calls upon certain features of the time-travel technology he has devised to settle things at the end, he demonstrates that the story has amounted to little more than wheel-spinning. Those same features could have settled matters much sooner and rendered the entire debate moot.

With *Mindstar Rising*, Peter F. Hamilton gave us a world where global warming has shot off the scale to turn dewy England into a tropical paradise. Or 'twould be paradise if it weren't for the Socialists who had ground the country into the ever-rising mud. But the Socialists are out, the Conservatives are in, business is returning, the economy is improving, the refugee camps are being sorted out, and please meet Greg Mandel. The army once spotted in him a spot of psi talent, implanted an engineered gland that could flood his system with psi-boosting neurohormones, turned him into an interrogator who can tell when one is lying, and shoved him into the Mindstar Battalion. Now he's a vet, still equipped with the gland, and he keeps getting drafted to help out with little problems.

In **A Quantum Murder**, that means the gruesome murder of star physicist Edward Kitchener, who invites six high-level students at a time to spend two years in his mansion, studying at the master's knee. (The girls get to sleep with him, too.) At the time of the murder, the mansion is isolated by a storm. The only suspects are the students. However, Greg passes each of the students as innocent—until a test of a neurohormone tailored to let users peek into the past shows supergenius Nicholas Beswick to be the perpetrator.

It doesn't seem possible. Nicky is painfully shy. The murder was the act of a maniac. Indeed, it matched the modus operandi of a particular mass murderer maniac now locked tightly in a maximum security prison whose director is working on ways to implant false memories with lasers, and thus to rewrite a maniac's warping past. And no, the maniac did not get loose that night.

Hamilton deftly guides the reader past the puzzles to a suitable resolution. The tale trots right along, a definite page-turner, and it does a fine job of entertainment. It has one great weakness, however—the psi, supernatural talents that pop up in new variations every time the plot needs a

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bit of help. Bafflegab about bioengineered glands doesn't help remove this from the realm of fantasy or make it acceptable to any sort of rational reader. I think that Hamilton could have told much the same story, to better effect, if he had found a more realistic substitute for this magic wand.

We don't see as many anthologies and collections as we used to because the major publishers have decided they do not generally sell as well as novels. And that's a shame, for there are many writers who are not so famous that millions of fans will snap up anything with their name on it, yet who do very interesting work at shorter lengths.

That's OK, you say? You subscribe to a magazine or two, so you see it anyway? You see some of it, yes, but the market for short fiction isn't what it used to be, and an enormous amount of quality material languishes in the small press, when it is published at all. For instance, Michael Swanwick's "The Wireless Folly" appeared in the February 1992 issue of something called *Thunder's Shadow Collector's Magazine*. (Ever heard of that one? I hadn't.) It isn't really a story, for all it does is describe a monstrously Gormenghastian mansion begun by mad Victorians, taken over by amateur radio nuts, invaded by Lemurians and "After World War Two. . . an influx of . . . cool-eyed, wise-talking gals and guys, many of them ex-GIs," and attacked in the 1960s by young radicals. "And while some elements are shoddily built . . . taken as a whole it remains an undisputed work of genius, and one of the great eccentricities of our age."

What's he talking about? What else but science fiction itself, and it is quite a marvelous portrait in metaphor, a delight, and all the reason you need to buy the book it introduces: **A Geography of Unknown Lands**. In addition, you will get the never-before-published "Mother Grasshopper," which concerns life and death on a planet that is a giant grasshopper (an unknown land, indeed). There are also four more equally marvelous, equally strange tales, including "The Edge of the World," in which three teens follow a dilapidated stairway over the literal edge of the world to a realm where wishes come true.

Swanwick is well worth your attention.

If you're a collector, I have two items here that may interest you. The first is Gary Lovisi's slim **Collecting Science Fiction and Fantasy**, in which he attempts to make you an instant expert in cover art and paperback types and grades. He includes some of the history of collecting SF and fantasy, including horror; lists useful reference material; says a bit about shows and auctions; and provides a few notes on how to sell your collection and become a dealer. This guide seems designed for beginners but collectors with some experience should find something useful here as well.

Darrell Schweitzer's **Poetica Dementia** is for Schweitzer fans, hardcore collectors of Lovecraftian dog-

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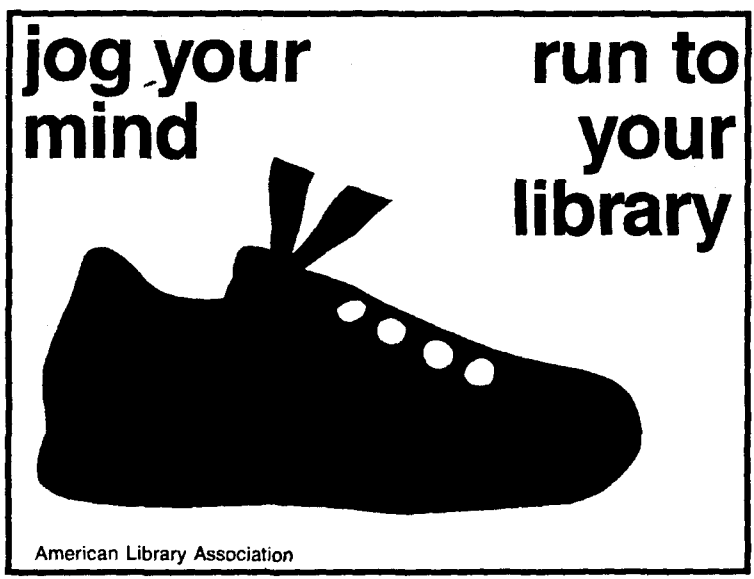
gerel, and anyone else who can be persuaded to part with four bucks. It's much like its predecessor, *Non Compost Mentis.*

Here's a sample:

A close friend of mine
has the face of a slug,
a fungus-like body,
and the claws of a bug.
On top of that add in
antennae and wings;
I guess you could say that
he's One of Those Things. . . .

Be warned. Or enticed. Whatever. Thomas Brown's illustrations are nice. ■



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BRASS TACKS

Dear Drs. Schmidt and Mallove:

"Cold Fusion: The 'Miracle' Is No Mistake" by Dr. Eugene F. Mallove (July/August 1997) demonstrates the General Semantics dictum that we unthinkingly attach expectations to the label for a class of things, expectations that keep us from accurately seeing the actual thing(s) so labeled. Even when we are face-to-face with the actuality.

Some years before the Fleischmann-Pons press conference, *Analog* ran a short story in which the developer of a miniaturized hydrogen fusion power generator cannot get anyone to even look at his suitcase-sized demonstration model. Why? Everyone assumes fusion requires huge magnetic bottles. So he sets up a dummy corporation that gets the device evaluated—as a compact storage battery. He can't change the experts' expectations, so he changes the label!*

I suspect that's what Japanese experimenters are doing by calling their cold fusion efforts "new hydrogen energy"—changing the label.

While I agree with Dr. Mallove's thesis, on my second reading I noticed occasional depreciating terms for the critics of cold fusion phenomena: "tomak reactor Sun Worshipers," "pack-mentality journalists," etc. I also noted a gloat or two over the critics' coming disillusionment.

I can well believe that Dr. Mallove, frustrated by years of failing to open the eyes of the willfully blind, has unwittingly allowed his frustration to color his writing style. I would urge him to nip in the bud any future use of depreciating terms for established authorities, and of language that smacks of "I told you so." Such writing, indulged too often, is a hallmark of the pseudo-science crank (see *In The Name of Science* by Martin Gardner [Putnam, 1952]), and might put off some otherwise receptive readers.

I am also mindful of an epigram that goes, roughly, "We must take care that, by dint of railing against idiots, we do not become idiots ourselves."

RICH BOOTHE

Los Angeles, CA
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*Even earlier, in one of H. Beam Piper's *Astounding* shorts—"The Return" (?)—a character remarks in passing that the nuclear reactor industry suppressed for years the discovery of direct radiation-to-electricity converters. You don't suppose those people are behind the media silence on cold fusion. . . ? But I digress.

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Dear Dr. Schmidt:

I am writing to complain about the cold fusion article that you ran in the July/August issue. My complaint is not about the topic, which is right in line with *Analog*'s history of publishing provocative pieces that contradict the prevailing wisdom. This editorial tradition has delighted me since the early days of my subscription over thirty years ago. Rather, I want to complain about the whining tone adopted by Dr. Mallove.

Like many, I was initially very excited about the Pons/Fleischmann announcement of "cold fusion." I was also intensely disappointed when many initial reports failed to confirm their results. Since my own field involves neither physics nor electrochemistry, once the initial excitement passed and stories about cold fusion faded from the pages of generalist publications, I lost track of the ongoing research in the field. Thus I was happy and excited to see a science fact article on the topic in your most recent issue. The experimental results and extensive citations provided on progress in understanding the Pons/Fleischmann results was wonderful. Unfortunately, there was too little of it. Instead, by my count, 7 of the 13 pages of text in the article were consumed by Dr. Mallove's rant against the scientific establishment and threats of retribution to come once cold fusion comes into its own.

I have no doubt that the proponents and researchers in cold fusion have gotten a very cold shoulder from the physics establishment. This is precisely what you would expect based on Thomas Kuhn's well known book, *The Structure of Scientific Revolutions*, which suggests that science advances by adopting a paradigm which more precisely describes the world than the previous paradigm. Eventually, paradoxes arise that are not explicable in terms of the prevailing paradigm, at which point a new scientific revolution occurs. Since the Pons/Fleischmann results are not explicable in terms of the prevailing notions of nuclear structure and atomic interactions, of course, they were always going to be rejected initially. The point is "Truth will out" in science even more than in life. I would have been much more gratified by the article if Dr. Mallove had confined himself to a presentation and detailed analysis of the results, plus some of the near- term implications. (e.g. When will I be able to buy a Pons/Fleischmann cell to power my house?) Beyond my own gratification, I think the article would have been much more valuable. Otherwise, keep up the good work.

JOHN HOWARD BROWN
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Dear Dr. Schmidt:

I just got through reading the July/August issue, which included the novelette "Sam Boone's Dry Run." While I enjoy all the Sam Boone stories, author Bud Sparhawk should be advised that if he does not know the Latin term for foot fetishist (I don't either—maybe "PODophile"?), he should stick to characterizing the Bingnagians as foot fetishists, not "pedophiles." A pedophile is someone who is sexually attracted to children.

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If a foot fetishist should move into my apartment complex, I wouldn't care as long as he left my feet alone. However, I have an eight-year-old boy who is acquainted with practically everybody in the complex. Last Halloween he dragged me to the doors of dozens of people I'd never met before, but he knew their kids. If a pedophile were to move in, I would join forces with the watch group in an effort to persuade him to move somewhere else.

PAULA STEINER

steinerjp@aol.com

It was a joke, *Ma'am! In case further elaboration is necessary, the author elaborates. . . .*

Dear Ms. Steiner,

Glad to hear that you enjoyed the Sam Boone series. It is always nice to discover that someone besides the *Analog* staff and my family is reading them.

While I respect your maternal feelings regarding the possibility of pederasts lurking nearby, I think you misconstrued my use of the term "pedophiles" in "Sam Boone's Dry Run."

I used the term "pedophile" because just a few lines earlier I used the term "pedal extremities" and thought that it would make more sense to use the same Greek root word. Perhaps I should have used the less pure Greek form of "ped-a-phile" or a more Latinate-Greek combination of "ped-i-phile" instead. Using the words "foot fetishists," as you suggested, might be more precise, and not nearly so apt nor as humorous. I don't think POD-ophile would have worked either, but I think I might use it later whenever I find a shelled race of aliens to apply it to.

By the way, it was the Adrinns who appeared to have the interest in each other's feet, not the Bingnagians; probably because the Bingnagians have fewer limbs of interest and the danger of being accidentally stomped when sniffing is considerably higher.

I noticed that you wrote about joining a watch group to "persuade HIM to move elsewhere." It is very dangerous for parents to assume that only adult men can be pedophiles.

BUD SPARHAWK

Dear Stan,

Ben Bova's "The Voice of Authority" in the July/August issue begins amusingly enough, although it hardly covers unfamiliar ground. However, when the anti-Environmentalist agenda becomes clear, the article turns first smug, then unconvincing.

Bova is arguing by false analogy, trying to group statements about specific technical developments, which have proven themselves definitely wrong, with more general statements which *haven't* been disproved.

William Vogt's *Road to Survival* seems to have argued that as various resources are depleted, prices will go up and wars may result. I am sure many of the specifics didn't work out, but would anyone seriously question the premise that finite resources can be consumed to exhaustion, and that the diminishing supplies will get more and more expensive? We haven't had World War III over this yet, but what was the Gulf War over if not the

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control of a finite and increasingly expensive natural resource?

Would Ben also question the idea that if population grown remains unchecked, it will outstrip the food supply and starvation will result? I am sure that many of the details in *The Population Bomb* proved no more accurate than those on Jeanne Dixon's *A Gift of Prophecy*, but in many parts of the world people *are* starving, and population pressure in the Third World seems to be only alleviated by the spread of AIDS.

Now we know, given the dismal environmental record of the former Soviet Union and its satellites, that Socialism is *not* the way to a clean environment, so I guess we can dismiss Barry Commoner, but I'm a whole lot less sure about the rest.

One day *all* the petroleum, gold, zinc, etc. will be extracted, and unless someone can make more, there will be no more. (Chances are before that point comes, petroleum will be too precious a substance for anyone to dream of *burning* it; other energy sources will be in use.) I am less sanguine that Ben Bova is about our ability to solve our problems, and I do not think that denial is the way to go. History is full of examples of short-term interests leading to long-term environmental disaster, from the deforestation and over-farming of northern Africa in Classical times—Who would ever *imagine* today that Algeria and Tunisia would be regarded as a breadbasket capable of feeding Europe, or that Lebanon would be a major source of timber?—to the collapse of Mayan civilization, which seems to have come about because the slash-and-burn agricultural methods then in use depleted the soil. Surely as the problem became more acute, there was some Mayan somewhere who said, "Maybe we ought to do things differently," but he was not listened to and the problem was *not* solved, and the great cities of the Yucatan had to be abandoned.

We are fools if we don't think something like that can happen again.

DARRELL SCHWEITZER

Strafford, PA

The author replies. . . .

Out of his own mouth Darrell Schweitzer condemns himself. Yes, human shortsightedness has led to ecological disasters. Yes, Algeria and Tunisia are no longer major grain producers and the cedars of Lebanon are but a memory. Yet the world's population is about six billion people! So these disasters have not stopped population growth.

The famines in Africa and elsewhere do not stem from lack of food, they are caused by lack of food distribution, which is a political problem, not an ecological one. And if some day "*all* the petroleum, gold, zinc, etc. will be extracted," as Darrell says, we will move on to other resources—or maybe draw our resources from other parts of the solar system.

Eco-extremists fear any change in the global environment, yet change is the hallmark of biological systems. And we cannot give up our current technologies without killing off billions of poor people around the world. Better to face the facts and

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work out new ways of feeding, clothing, and *educating* people with as little environmental damage as possible.

As for the quote attributed to Thomas Watson, my source is the British Interplanetary Society's journal *Spaceflight,* the July 1992 issue.

BEN BOVA

Dear *Analog,*

I read with interest "The Orphan Experiment" (*Analog,* July/August 1997). I have a sister-in-law who was employed by an educational psychologist at the University of California, Berkeley in the 1950s to paint a series of simple wooden picture puzzles. Each one posed a different simple social situation with removable head, arms, legs in different racial skin colors. They were given to preschool children to "play" with to see if very young children would show racist attitudes. Conclusion: There were none. Racism is a learned behavior, mostly from a child's early social environment. I do have a problem with the "Orphans of Eden" approach, which I characterize as "the if" solution (Page 10, paragraphs 2 and 3). Too much wasted time, too many blunders are the result of that big-little word—IF! Too easily it becomes a cop out.

ROBERT GOODWIN
Robert_Goodwin@RedwoodFN.org

Dear Dr. Schmidt:

Please restore the title of the story to the bottom of the page. The full meaning of the title is often not obvious until the story is well under way, if not completed. I doubt that many readers go back to the title page after reading the story, making any cleverness that the author has used in titling his work moot.

As for the issue July/August issue, it has been so far (I'm up to page 150) one of the worst you have ever put out. Two cases in point-the article by Dr. Eugene F. Mallove and the novella by Walter F. Cuirle-have very serious problems.

Mallove's article requires that he have credibility in his arguments. He argues that the science community has accepted a position based on incomplete knowledge and that it refuses to deal with data that undermines this position. I have no problem with this argument. I do, however, object to his inconsistency when he cites "global warming" as a reason to proceed with cold fusion research. After all, the same general description of events applies in this area as well, with satellite measurements that show a slight cooling trend being dismissed as error because they don't fit in to the computer projections (and assumptions) that predict catastrophic warming. The inconsistency diminishes his credibility and, hence, the value of his arguments.

Why is it that the brand of bigotry exhibited by Cuirle and his ilk are tolerated by you? The right is consistently portrayed as the force behind censorship, while it is the left that has been behind the attempts to limit free speech through the political correctness movement, the attempts to shout down conservative speakers on campuses, and attempts to ban books such as *Tom Sawyer* or *Huckleberry Finn.* I doubt that you would publish

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a work of fiction in which Blacks are portrayed as shiftless, lazy and either involved in crime or sitting around collecting welfare and eating watermelon, or another story in which Asiatics are portrayed as they were in the "Yellow Peril" days of the thirties. While publication of these types of stories would cause picketing of your office, equally groundless attacks on conservatives are accepted at face value. Please try to be a bit more balanced in the future.

RICHARD CITTI
richard.citti@sba.gov

If you are going to attack us for "lack of balance," you can't simply ignore the many potshots we've taken at "political correctness," etc., in both stories and editorials. Such inconsistency diminishes your credibility. And while we would not publish anything characterizing all *members of any ethnic group as fitting any stereotype, we reserve the right to characterize* particular individuals *of any group in any possible way. If this bothers you, I respectfully suggest that you read—carefully—my August 1979 editorial, "Equal Rights for Dumb Blondes."*

Dear *Analog*,

When I first read Walter F. Cuirle's "Billy's Bunter" in the July/August 1997 issue of *Analog Science Fiction and Fact* I found it unbelievable. However, the following article is from the Opinions section of a small local not-quite-throwaway newspaper: *The East Mesa Independent*–July 9-15, 1997:

"Disruptive Students Act in force this school year.

Now that school is out, I wonder how many teachers—never mind the students or their parents—know about the House bill that will become law this month. I refer to the Disruptive Students Act, which is basically three strikes and you're out. Any chronically disruptive students who get three major infractions or five minor infractions can be dropped from class. If you are dropped from enough classes, then you will be dropped from school or expelled. Think about it: The kids who are the last to arrive or the first to leave have one infraction. Talking in class is another. Having a negative or aggressive attitude In class and you can be dropped. The teachers will just compile a list. Once they get enough infractions, they will be reassigned to another class or study hall. That doesn't help if they are dropped from classes that they have to take."

How nearsighted can people be?

STEVE BLEICH
Mesa, AZ
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If you come to a fork in the road, take it.

—Yogi Berra

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UPCOMING EVENTS Anthony Lewis

23–25 January 1998
CONFUSION 18 (Ann Arbor area SF conference) at Van Dyke Park Suite, Warren MI. Guest of Honor—Connie Willis; Science Guest of Honor—Marvin Minsky; Artist Guest of Honor—Jane Irwin; Fan Guest of Honor—Mary Ellen Wessels; TM—Larry Tucker. Info: ConFusion, PO Box 8284, Ann Arbor MI 48107; (313)487-8743; email: confusion@stilyagi.org; URL: http://www.stilyagi.org/cons/confusion.html.

13–15 February 1998
BOSKONE 35 (New England area SF conference) at Sheraton Tara, Framingham, MA. Guest of Honor—Walter Jon Williams; Official Artist—Omar Rayyan; Special Guest—STANLEY SCHMIDT; Featured Filker—Joe Ellis. Info: Boskone 35, PO Box 809, Framingham, MA 01701-0809; (617) 625-2311; FAX: (617) 776-3243; email: boskone@nesfa.org; URL: http://www.nesfa.org/boskone/flyer.html.

13–15 February 1998
RADCON 2B (Washington state SF conference) at Tri-cities, Wash. Guest of Honor—Jerry Oltion; Artist Guest of Honor—Russ Campbell; Science Guest of Honor—Dean Ing; Fan Guest of Honor—Betty Bigelow; Up and coming—Greg Abraham, Info: Radcon, 2527 W. Kennewick Ave. #162, Kennewick, WA 99336; (509) 967-3248; email: radcon@oneworld.owt.com; URL: http://www.owt.com/radcon.

27 February–1 March 1998
CON-DOR (southern California SF conference) at Town and Country Hotel, San Diego, CA; Guest of Honor—Harry Turtledove. Info: Con-Dor, PO Box 15771, San Diego, CA 92175; email: dkeais@aol.com; URL: http://users.aol.com/sdcondor/condor.html.

5–9 August 1998
BUCCONEER (56th World Science Fiction Convention) at Baltimore Convention Center and nearby hotels, Baltimore, MD. Guests of Honor—C.J. Cherryh, Milton A. Rothman, Stanley Schmidt, and Michael Whelan; TM—Charles Sheffield. Registration until 30 September 1997: $110 (80);supporting $30 (22); children +4 to 12 $55 (40); children 0.75 to 4.0 FREE (all ages as of 5 August 1998). [These are the latest posted rates as of the time this column went to press.] This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info: Bucconeer, Post Office Box 314, Annapolis Junction, MD 20701. email: baltimore98@access.digex.net; URL: http://www.access.digex.net/~balt98. ■

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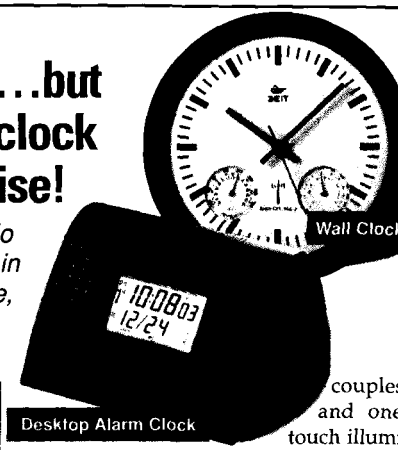
TECHNOLOGY UPDATE

You can buy a Rolex®...but for $99 you can get a clock that's even more precise!

New Zeit Clock by Arcron uses radio signals from the U.S. Atomic Clock in Colorado to display the precise time, within a billionth of a second.



These days, timing is everything. Between meetings and appointments, deadlines and conference calls, my schedule requires that I know the time down to the minute. If I'm late, I'm sunk. Now there's no need to worry, because the Atomic Clock by Arcron gets the time directly from the U.S. Atomic Clock in Fort Collins, Colorado, the standard for time-keeping the world over.

The most accurate clock on Earth. Every morning at 1:00 a.m., this "smart" clock tunes in to the radio time signal emitted by the U.S. Atomic Clock in Colorado and automatically resets itself to the exact hour, minute and second. The U.S. Atomic Clock is accurate to ten billionths of a second per day. The Atomic Clock even adjusts automatically for daylight savings time, so you don't have to remember to "spring forward" or "fall back". The desktop model is the only clock that will not lose time with low power or when you change its batteries.

An easy time. The most accurate clock in the world is of no use if it is difficult to operate. The Arcron Atomic Clock comes in two styles, the wall clock and the executive desktop model. Both are designed to be functional *and* easy to use.

The desk clock's display features the exact time (in hours, minutes and seconds), month and date, or you can choose to display any two U.S. or world time zones. It also has dual alarms, perfect for couples, and one-touch illumination for nighttime viewing. The handsome wall clock comes with temperature and humidity gauges. After you install the batteries, watch the hands spin at 20 times their normal rate, until the clock has adjusted to the precise time. Both the executive desktop and the wall model have an internal antenna for superior reception sensitivity, without unattractive wires.

The time to buy is now! Act now and you can own the world's most precise timepiece. Both the executive desktop and the wall model come with a one-year manufacturer's limited warranty and Comtrad's risk-free home trial. If you are not completely satisfied, return your purchase within 90 days for a full "No Questions Asked" refund.

*Rolex® is a registered trademark of Rolex of Geneva Corporation.

Atomic Wall Clock . . . . . $99 $8 S&H
Atomic Desktop Alarm Clock $99 $8 S&H

Please mention promotional code **2762-12030.**

For fastest service, call toll-free 24 hours a day

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